

The Effect of Functional
Periodicity on the Motor Ability of
Women in Sports



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INTRODUCTION

This study concerns itself with the effect of menstruation on the motor ability of college women in certain sports. It was undertaken principally for the following reasons:

1. There is at present an increased interest in the measurement of motor efficiency in physical education by means of standardized motor ability and physical efficiency tests of various types. Apparently, however, there is little or no evidence of the wider application of these tests during menstrual periods for the purpose of comparing results between critical and normal periods, and deducing therefrom the effect in games of functional periodicity on accuracy, skill, and speed of motion. This phase is obviously of interest to the field of physical education, a field profoundly affected by the physiological phenomenon in question, and, as yet, unable to cope with it scientifically.

2. There is, also, an imperative need for the constant accumulation of data on the entire subject of menstruation. Few subjects have been, and still are, so clothed in worn-out traditions and excess modesty. Few subjects so important to health are still regarded with such conflicting opinions. We do not yet know the best way to handle it in our schools. Every careful study of periodicity will, therefore, add something of value to our knowledge regarding the problem.

It is a peculiar thing that a process which has been with women since the beginning of time should have been considered a mark of inferiority and disgust. Yet, undoubtedly, such was the case, and literature abounds in stories of primitive practices indulged in by savages at menstrual times. These practices seem mainly to insist on isolation for fear of contamination of food or causation of disease. Frazer (28) and Hall (34) quote many such instances. These superstitions existed also among our American Indians, and Beard (8), quoting from that interesting journal of Lewis and Clark written in 1802, says:

"I observe a small lodge with a fire which seems to be the retreat of their women. The men are not permitted to approach this lodge within a certain distance, and if they have anything to convey to the occupants, they stand at a distance of 50 to 60 paces and throw it towards them and then retire."

These old ideas, unfounded as they may be, have persisted in the face of medical progress and health education. As recently as 1920, a doctor (6), writing from India, voiced the opinion that, "Unfortunately the principle of isolation of menstruating women is being given up and the girls are now taking up some form of exercise and thereby undermining their constitutions." It is apparent that we are still, at least partially, bound by the most pernicious beliefs and traditions. There are few teachers who have not found among their students ideas regarding this function that verge on the superstitions of savagery. Women

still accept periodic disability as inevitable; many refuse to bathe or exercise. The terms "sick time" and "unwell" have indeed become firmly fixed in our traditional thinking. Thus, this personal index, the result of home training passed down through generations, makes any careful accurate study of menstruation and efficiency an exceedingly difficult one.

In general, however, our ideas concerning periodicity are becoming more scientific and sensible. We have swung, in the brief space of twenty years, from Havelock Ellis' opinions (26): "Everything woman says or does must be judged by its exact position in this cycle which permeates her whole physical and psychical organism," and again, "Whenever a woman commits a deed of violence, it is extremely probable that she is at her monthly periods" to the saner views of Clelia Mosher (51), who believes that physicians themselves, as well as women in general, must alter their morbid ideas towards menstruation and that too much of a woman's life has been translated into those terms. In her excellent little book (51) she says:

"If every young girl were taught that menstruation is not normally a bad time and that pain at that period is as discreditable and unnecessary as bad breath—we might almost look for a revolution in the physical life of women."

With the change in opinions regarding this function came also a discernible change in behavior during periods. Repose in bed and complete rest was formerly the universal prescription at this time, and even yet, Goodsell (32) finds the majority of schools still excuse girls for part of their periods. The more progressive of them, however, are advocating continuous exercise and thus follow in the footsteps of that pioneer, Jacobi (39), who, in 1876, concluded from her investigations that,

"There is nothing in the nature of menstruation to imply the necessity or even the desirability of rest for normal women" and that, "We are warranted in concluding that insufficient exercise during school life may be one factor in the production of painful menstruation."

In general, schools follow one of four methods of handling periodicity, namely: (1) Excuse girls from class work in physical education; (2) Prescribe rest periods; (3) Prescribe remedial or modified work; or (4) Encourage regular routine of class work. The first method is still the most common, but the trend is apparently towards the last method, although, as previously stated, school authorities are still in the dark concerning the problem.

E. H. Arnold (4) concludes from data collected from his physical education students that increased mental and physical work during menstrual periods have made the periods scarcer, milder, and shorter, thereby increasing the working capacity of his students. In a later paper (3) he wonders if the future results of this will be beneficial for, "Whenever economic efficiency is the deciding factor, restriction of menstruation is profitable;

whenever fertility is of importance, it is undesirable." Mosher (53) (54) is also an advocate of exercise as a regulator of the period. Meredith (47) finds in her study that discontinuing invalid habits (i. e., of mind and body) was the chief factor in the reduction of dysmenorrhea in her group.

English investigators have contributed much to our literature along this line. In spite of the more conservative opinion of the British Board of Education (40), Drs. Gray (33), Chisholm (16) (17), and Clow (20) (21) have made investigations among English school girls which indicate the beneficial results of continuous supervised exercise and sports. There seems to be little doubt that exercise decreases physical and psychical discomfort during periodicity, as well as restricts menstruation, and in some cases, causes cessation of the function for months at a time. Whether this will have a deleterious effect on the function of child bearing in later years we do not yet know.

Some forty or fifty years ago, with the rise of the movement for higher education for women, came a veritable chorus of protests, warnings, and prophecies as to the effect of college life on the health of women. Human beings inevitably regard new movements with fear and suspicion. From Clarke (19), who, in 1873, declared a girl could not reach a man's standard of education without doing it at the expense of health, and Van Dyck (73), who, as recently as 1905, made such an unfounded statement as,

"The modern university graduate might command respect for her intellectual gifts, but her ability to confer happiness and to raise strong, vigorous offspring is very limited. Hard study and lack of exercise weakens the body and arrests the natural development of the pelvis."

we come down to the present day when such authorities as John Dewey (25), Preston (66), Newcomer (60) and others testify statistically that the health of college women does not deteriorate because of school life. Mosher (55) (56) (57) in particular has made studies of the increased weight, height, and strength of college women and concludes their health has been improved.

Many illustrations could be quoted to indicate the difference of opinions still held by the laity and medical profession regarding the cause and method of handling of menstruation. An important step in the clarification of our viewpoint is the increasing acknowledgment that many cases of so-called dysmenorrhea are in reality not due to physiological causes but psychological, which require treatment of mind as well as treatment of body. Were we, as Mosher said, able to convince women that their attitude in the majority of cases is the result of "mind set" and home training, ill-founded and illogical, we might, in time, well hope for a tremendous increase not only in the working capacity of women, but in their enjoyment of life as well.

This study has extended over the best part of two years, and is based on material collected from the students at Purdue University during 1925 and 1926. The method of work was suggested by Hollingsworth's study (36) and the questionnaire used after each performance is identical with hers.

My thanks are due to Professor H. H. Remmers and Mr. R. W. Babcock, of the Purdue faculty, for their helpful co-operation, also to Dr. John Sundwall, of the University of Michigan, who, in his understanding way, has been most appreciative of my efforts. My sincere gratitude is due also to my friend and colleague, Miss Idabelle Post, for her loyal assistance in tabulating and proof reading. Particularly, I am grateful to the men and women students at Purdue who have responded so faithfully to this task, and without whose aid this study could not have been accomplished.

CHAPTER I

THE EFFECT OF FUNCTIONAL PERIODICITY ON THE MOTOR ABILITY OF WOMEN IN SPORTS

Review of Previous Experiments and Literature

Functional periodicity is a subject so comprehensive in its implications to other fields that it is difficult to handle. It is tied up, not only with emotional and psychic reactions, but with economic, social and health problems of all women of child-bearing age. Because of this emotional phase, the result of thinking handed down to us from primitive days, only studies which use carefully controlled, definitely measurable means are of value. Introspective judgment is not a safe measuring rod.

This study does not purpose to review the many theories of menstruation advanced by such authorities as Novak (63), Seitz (71), Mosher (54), Corver (25), Chisholm (17), Brown (15), Jacobi (38), Young (82) and others, although the bibliography surveys much of this material. Nor does it concern itself with the cause and treatment of pathological cases of menstrual difficulties. It does not presume to be a medical treatise. It will, however, limit itself to the subject on hand, namely, the effect of periodicity on the motor efficiency of women as evidenced by certain tests, and to short summaries of associated phenomena.

While there has been considerable written on the effect of exercise on menstruation, little has been written on the effect of menstruation on motor efficiency. Peculiarly enough, this side has been neglected, not only by physical educators, but by industrial hygiene experts as well. In fact, most of the literature on industrial hygiene problems for women, such as that of Samuel Meaker (46), Gelhorn (29), Goldmark (31), Engleman (27), Anderson (1) and others, concern themselves almost solely with absenteeism from work due to this condition, fatigue elimination and the gynecological effect of certain industries. There seems to be no study on the actual piece-work output of women during critical contrasted with normal periods. We have too long accustomed ourselves to accept women as periodic invalids without proof of our opinions.

In general, we may say that the attitude is that periodicity must profoundly affect the mental and physical life of women. Psychiatrists join with physicians, laymen with educators, in this view. Many of these opinions are not the result of careful study and accurate test conditions. We must remember, also, that physicians necessarily secure their information largely from women who are not healthy, either in body or mind. If this function be of importance, it seems strange that it has been

ignored in practically all of the scientific studies made with women subjects. Even in studies of sex differences in mental work, or in physical movements, such as the dynamometer tests of Peakes (64) or the tapping tests of Frederick Wells (79), critical periods seem to be ignored. Hollingsworth (36) alone seems to have attacked the problem from this point of view.

Two experimental studies recently undertaken in this line should be mentioned—one under the auspices of the Normal Teachers' Association of Massachusetts and the other sponsored by the Women's Division of the National Athletic Federation, which intends to employ a research physiologist to conduct experiments over a period of at least three years. Interesting results may be expected from these researches.

In England, Dr. Clow (21) has studied records of approximately 1,200 school girls for a long period of time. She particularly stresses the value of continuous exercise throughout critical periods and health education on the subject. Her figures, taken from some 734 girls before and after daily exercise, are significant and worth repeating.

	Before Exercise and Health Education	After Exercise and Health Education
Regular menstruation	52.2%	71.5%
Irregular menstruation	47.8%	28.5%
No pain	67.8%	85.1%
Severe pain	1.6%	.5%
Incapacitated	5.1%	.9%
Rest during period	21.3%	6.2%
Baths during period	11.9%	42.0%
Games and exercise	36.3%	67.1%
Constipation	7.0%	2.5%

The effect of mental work on menstruation has long been a topic of controversy. Engleman (27) believes that mental strain increases the frequency of the flow. Van Dyck (73) claims that "cramming when applied to mediocrity" is the most frequent cause of dysmenorrhea. Hall (34) says that the normal woman in her prime, no matter how healthy, can do less work in mind and body during this period. He also believes that "education must heed the instability and susceptibility of the girl during the functional waves which permeate her entire body." Clow (21) thinks, on the other hand, that the "press of brain work affects menstruation adversely only in so far as it encourages sedentary habits."

More closely related to the problem before us are the following excerpts from literature. Engleman (27) says: "In short, mental and physical control and endurance are lessened at this period even in the healthy," and writes that there is diminished self-control and increased nervous tension, and believes that in any test of skill or strength everything must depend on the woman's position in her monthly cycle. Hall (34) says women

can make less accurate and energetic movements and mental activities are less brilliant at this period. These opinions are, however, not the result of careful statistical study and they are in direct contrast to the study of Hollingsworth (36), who has found no mental or motor inefficiency during periods of normal women.

Certain studies of physiological processes connected with the function have been made and should be noted. It must be remembered, however, that there may be other equally reputable studies showing conflicting results.

PHYSIOLOGICAL CHANGES DURING MENSTRUATION

Blood Pressure

Mosher (53) quotes results of blood pressure experiments with the sphygmomanometer on nine women and five men covering a period of 49 days. She observes a rhythmical fall in both men and women with variations not peculiar to sex—in women, a gradual fall near or at the menstrual period preceded by a short preliminary rise before depression with the maximum fall coming at the onset of the flow. This is followed by a gradual return to the mean. “The maximum efficiency of the individual corresponds to the time when the pressure is high and lessened efficiency to periods of low pressure, but in no case was the change sufficient to incapacitate the individual.” In both sexes the time of low pressure corresponded to the period of increased susceptibility. She concludes that much of the so-called dysmenorrhea is not dysmenorrhea, but simply coincident functional disturbances in other organs induced possibly by the favoring conditions of a lowered general blood pressure at this time. She presents no graphs or figures.

Amos (2) finds in 12 subjects a similar fall in pressure at the onset preceded by a rise, with a gradual return to normal at the close of the period.

Moore and Cooper (49) find a typical rhythm comparable to that of muscular efficiency, i. e., a low menstrual and high intermenstrual rate, “but the low rates during the menstrual period are not greater than many chance variations and do not signify an extensive general lowering of the physical condition.”

Pulse and Temperature

Cullis, Oppenheimer and Johnson (24) report on taking temperature both by mouth and rectum, on 16 subjects for periods varying from three to eleven months. The temperature shows a rhythm with the premenstrual rise and a sharp fall at onset. The lowest temperature is recorded during the menstrual period with a gradual rise to premenstrual heights. Many daily variations were noted. The pulse rate shows a faster postmenstrual

rise than the temperature, while the rate is lower during the menstrual period. They find no definite variations in blood pressure beyond a slight fall during the flow.

Chisholm (17) finds a general metabolic change with a rise in temperature, increased output of glycogen, calcium, and urea during the premenstrual period.

Giles (30) reports the maximum rise of temperature two days before the onset of the flow with a sharp drop at the flow. He says: "It may be regarded as established that a woman has no normal temperature, but that the thermometric reading depends of the stage of the menstrual period when the observation is made."

Ammonia Content

Bond (10) finds a marked rise in the ammonia content during the premenstrual period due to the increased output of urinary ammonia.

Calcium Content

Widdows (81) writes that she finds no cyclic variation in the calcium content of blood, although this content is higher at the beginning of pregnancy. Dr. Marie Stopes comments on this report and asserts that Dr. Widdows made her observations at the wrong time, for there is a difference during the menstrual and premenstrual periods.

Respiration Rate

Moore and Cooper (49) in a careful study made on eight subjects with a pneumograph find periodically recurring variations coincident with the monthly cycle with typical variations of a low menstrual and high intermenstrual rate. "The rhythm is especially marked and uniform in the pulse rate, circulatory index and in the respiration rate." "However, the low menstrual rates are not lower than many chance variations and represent only a phase in the rhythm accompanying the fundamental periodic changes which occur through the monthly cycle."

Basal Metabolism

Wakeham (74) asserts there is a fall in metabolism during or directly after the period with a premenstrual rise. His tentative conclusions are as follows: (1) Basal metabolism variation in due to the monthly cycle, although in every case this variation is less than average daily variations. (2) Variations are greater in active than in sedentary women. (3) The causes which produce too frequent menstruation are likely to be accompanied by higher metabolism while those which cause a delay in the flow or suppress the function are accompanied by a low metabolic rate. (4) Variations in metabolism are less among those who live uniform lives.

Blunt and Dye (9) question the validity of Wakeham's findings and report in their careful study of 216 observations that they find no periodic variations as such. "The postmenstrual fall does appear to be present in our figures, but it is so slight that we feel hesitant about drawing conclusions from it even with our comparatively large number of observations," and again, "the variation connected with the menstrual cycle is irregular and no greater than at other times."

W. Lanz (43) finds that menstruation does not affect metabolism in the healthy woman, but that it does have an effect on the sick woman when the rate increases before the period begins and decreases at the beginning of the flow.

Schmitt (68) reports his study of thyroid function and finds 40 cases of dysmenorrhea in which he sees 22 with increased and 7 with decreased basal metabolism.

Muscular Efficiency and Strength

Moore and Barker (48) using a spring balance dynamometer on 30 subjects for a period of approximately 20 months reveal a menstrual decrease in strength with an intermenstrual and premenstrual rise. "There is no evidence of a marked depression during normal menstruation sufficient to interfere appreciably with women's activities." They assert, "It seems reasonable to expect during the premenstrual period there would be an increase in tone such that the general physical condition would be improved. This would be followed by a reactionary period of depression coincident with the adjustment which takes place." "Menstruation is merely one of the events of the monthly cycle and one of less significance than the ovarian changes which induce it."

Peakes (64) makes intensive studies of periodic variations with the dynamometer with particular emphasis on the effect of the weather and time of day and temperature on muscular efficiency, but he apparently does not include in this study the effect of menstruation. He says: "Of course, there is no doubt of the 28 day period in females, but the existence of 28 day periods in mental and physical abilities has never been firmly proved or disproved as yet."

Mosher and Martin (57) in an interesting study of the muscular strength of 45 women conclude that there is no difference in muscular strength due to sex as such. Differences which exist are due to limitations of dress or activities.

Jacobi (39) finds that dynamometer tests show a slight lessening of ability during the menstrual period, while tests of weight lifting show a big decrease during and a rise before the onset.

Hollingsworth (36) reports there is no periodic motor or mental inefficiency in normal women and that the variability of

performance is not affected by physiological changes. She points out that in certain of the above experiments no control records were taken on men of the same age and condition of life to determine whether this variation is peculiar only to women. The fact that both Mosher and Hollingworth find fluctuations in the men's records as well as in the women's would raise the question whether menstruation as such were the cause.

In this connection, we should note that some investigators believe in a male cyclic rhythm. Church (18), from observations of a group of neurotic and unstable men, concludes this. He quotes also from Campbell (*The Difference in the Nervous Organism of Man and Woman*, London, 1891), who believes that males have a 28 day cycle and that "menstruation is a reproductive function which has, in the female, become grafted accidentally on this primordial rhythm."

Animal Experimentation and Estruation

A persistent search through literature fails to find any study made of the working capacity of work animals such as mares during periods of heat.* However, some experimental work has been done on the activity of rats in relation to the estrus cycle.

G. H. Wang (75) has studied 192 activity cycles in female white rats and reports a marked sex difference in activity in relation to the estrus cycle with the female rats showing cyclic changes in activity usually four days in length between peaks. Male rats also show variations but no regular interval between peaks. The greatest activity in female rats comes during estrus, so Wang concludes that activity cycle depends on the periodic functioning of the ovaries. Such cycles are absent during pregnancy of the rats, lactation, mechanical stimulation of the cervix, after removal of the ovaries and also before sexual maturity.

Richter (67) finds a relation between activity in adult rats and the periods of activity in the stomach. There is, he says, a great relation between food habits and activity. He evidently does not make any study of sex difference between rats in relation to the estrus cycle.

Slonaker (72) experiments with eight young adult female rats and finds spurts of activity every four days, as Wang did. He sees no activity rhythm in male rats. The character and amount of this female activity varies with the food, age, and individuality of the rat.

From the literature summarized above so briefly, two assumptions may be made, namely: (1) If we accept the theory

*Dr. W. L. Williams, Professor of Veterinary Surgery at Cornell University, writes me as follows: "Mares do not recognizably menstruate. In estrum, the mare is decidedly temperamental and inpendable. She is perhaps defective in strength. In woman there is apparently no well defined estrus cycle and so leads to some confusion in comparative study."

that functional periodicity is not an isolated phenomenon of any great importance, but only one symptom of recurring changes, none of which are extensive enough to interfere greatly with efficiency, then any variations in motor skill which may occur would be present equally in both sexes with no reference to this function. (2) If, on the other hand, we believe that menstruation has a profound and disturbing effect on the whole organism of woman, we may expect to find a considerable lessening of motor efficiency at these periods in the female.

Such variations in performance as are present could be measured by some of the various types of motor tests used by physical educators everywhere. A review of this veritable flood of reports becomes an involved task, not only because of its volume in recent years, but because of the apparent indiscriminate juggling of the terms "motor efficiency," "physical achievement," "motor ability," "physical efficiency" and the like.

This paper does not interest itself with the numerous tests of physical efficiency which use mechanical apparatus for testing purposes such as that used by Schwegler and Englehardt (70), the Martin Spring balance test, the Sargent test, the pursuit pendulum, the Dawson balance test, the Ryan and Agnew grip test and others of this order described by Collins and Howe (22). It does, however, concern itself with those tests of motor ability and actual performance in games and sports used in colleges. As previously stated, there apparently has been no application of these tests during normal and critical periods with a view of contrasting results of the two.

The increasing popularity of motor tests of all types is but a natural sequence to the tendency to standardize everything in education. Physical tests quite naturally followed mental tests. They are but a reflection of our modern thinking and desire to obtain the best results whether it be in business or in education. Again, personal judgment as a measuring rod in education has been found to be inaccurate. Carefully devised tests which would act not only as real incentives to the students but as accurate measures of ability for grading purposes are necessary. Hence the universal adoption of these tests.

Brace (11), Barrow (7), Nichols (61) and Wayman (77) summarize the use and value of motor ability tests in colleges. Wayman (77) (78) in particular has made important contributions along this line. She distinguishes between physical efficiency and motor ability and believes physical efficiency to be the larger term taking in more than mere neuro-muscular control. She has therefore devised a combination medical, anthropometric and motor ability test which is used in many women's colleges.

In November, 1925, a committee of the American Physical Education Association published a review (58) of the various game-skill and athletic tests in present day usage in schools and colleges. These tests are adapted to age, sex, and grade. The survey is a comprehensive addition to our literature on the subject.

The 1920-21 Proceedings of the Athletic Research Society contain three articles on methods of measuring motor efficiency in the elementary school, high school, and college by Hummel (37), Way (76) and Nichols (61) respectively. Hummel pleads for a simplified system of measuring motor efficiency easily applied by the teacher. Way finds a great confusion of ideas as to what is meant by physical efficiency with a consequent variety of tests as to content, and type. Nichols gives an excellent resume of athletic tests used largely in men's colleges.

Maroney (44) has applied tests to a large number of grade and high school students and concludes they are a valuable aid in stimulating interest in physical education.

The Playground and Recreation Association has done much to stimulate competition in games and stunts among grade school children by evolving a series of three Athletic Badge Tests (5). Badges are offered for the successful completion of these tests. The baseball throw and the volley ball serve used in this study have been taken from this series.

Brace (12) (13) (14) has experimented for some time with Teachers College students and has evolved a number of excellent game tests and group stunts. The soccer and baseball tests used here at Purdue were taken from his list.

In summarizing these athletic tests, it will be found that all are based on four fundamental activities of throwing, running, climbing, and jumping. The principal physical qualities measured by them are speed and agility, co-ordination and skill, strength and endurance. Swimming, for example, includes many of these elements and is, therefore, a very good all-round test. The co-ordination of small accessory muscles used in highly skilled acts depends largely on a foundation of well-developed big muscles. Big muscles therefore are the basis for all bodily skill. The game tests used in this study are based on these big muscle activities and lay the foundation for the playing knowledge of the games in question.

Schneider (69), who classifies all tests into performance or non-performance tests, objects to both types as not being absolutely satisfactory. He believes the performance tests to be influenced by practice, interest, co-operation and alertness, while the non-performance tests (of involuntary processes) are influenced by emotions. This is, undoubtedly, to some extent true, and in reviewing tests we must realize that all of them, whether

mental or physical, have their limitations, and that we must not allow them to form too large a part of our curriculum. No workable tests have yet been devised to measure the social and moral qualities, such as sportsmanship, co-operation, loyalty, etc. Nor can habits of health and recreation be scientifically measured. A great deal of scientific work must be done in this line. More definite standards for grading must be adopted and tests must be more uniformly administered and interpreted.

CHAPTER II

THE AIM, PURPOSE, AND SCOPE OF THE EXPERIMENT

The purpose of the study was to measure the effect, if any of menstruation on the accuracy, skill, and speed of women in certain athletic tests. This brings the subject into the field of physical education, and it becomes of particular interest to teachers of physical education to know the status of women's physical efficiency all the time. If we have been planning our physical education programs on the assumption that women are periodic invalids whose ability and skill are diminished every 28 days, and we prove to be correct in our assumption, then our educational as well as our industrial systems must take cognizance of this fact. If, however, we prove to be wrong, we must alter our habits of work and play and particularly our habits of mind regarding this natural function. It is time some clarification of our views and our methods takes place. It seems odd that, if women's ability is diminished, they should be employed, and continue to be employed, in those industries where the pressure for large and fast production is so tremendous.

In planning this experiment, it was thought wise to select athletic tests which have been in use for some time, and hence have been thoroughly tried out and found workable and easily measurable. The tests chosen all contained important elements of the seasonal sports taught to the students, and held, therefore, real interest for the subjects.

The tests were given in the gymnasium, every day except Saturdays and Sundays, under uniform conditions, by the same person and in the same order. They were not all given at the hour, as this was impossible to arrange with the difference in class schedules. However, as each subject took her daily test at her particular hour, with no variation from this assignment, hourly fluctuations in working capacity and skill would have no effect on individual records. Any departure from the usual, such as emotional excitement, physical disability, etc., was carefully recorded on blanks provided for that purpose. Everything possible was done to conduct the test under uniform conditions, free from disturbing factors.

It was not easy to find any very large group of men and women who could so arrange their habits of living for a period of nine weeks to allow time for this daily experiment, at the same hour, and who were interested enough to give up their time without any compensation whatever. None of the subjects was informed as to the purpose of the experiment for fear of influencing the results.

Two groups were chosen. Group 1 consisted of six normal, healthy girls, who were, as far as could be ascertained, neither psychically nor physically handicapped by menstruation. All of these girls were in the habit of continuing regular sports throughout their periods. They were rated as "A" in their physical examinations. They experienced no nervous symptoms at their periods. Five of this group were "athletic" girls, while one girl was a clerk at the University, whose only exercise was walking and dancing.

Group 2 consisted of eight girls, normal as to weight and health, and rated "A" in physical examination, except as to menstrual difficulties. These girls were either habitually psychically influenced by periodicity or actually suffered from moderate to severe physical discomfort and dysmenorrhea during some part of each period. They were in the habit of either modifying their exercise or eliminating it entirely. All of them could be rated as "athletic" and belonged to class or sorority teams. Three girls from Group 1 were also continued with the second group, making a total record of 90 days for each of these three.

Group 3 consisted of five men used as controls, who performed tests identical to those given the women, under identical conditions.

Ages ran from 17 to 22 years. Five Juniors, three Sophomores, nine Freshmen, one graduate student, and one non-college girl comprised the groups. Group 3 consisted of two Juniors and three Freshmen. Both men and women were typical American college students.

Group 1 began its experiments on October 19, 1925, and continued until December 19, 1925, making a total of 45 records. Group 2 began on January 6, 1926, and continued until March 10, 1926, making a second collection of 45 records.

In the subsequent charts of this study, menstrual periods are indicated by placing a star (*) on the records of critical days. In analyzing individual periods we are reminded of what G. Stanley Hall (34) says: "The diversity of theories (regarding menstruation) is probably not so wide as the range of individual variations." The intermenstrual period for many of the subjects was not uniform. The actual period not only varied in length in different individuals, but from month to month in the same individuals. In one girl from Group 1 and two girls from Group 2, only one critical period was recorded during the entire nine weeks.

Each subject at the end of her testing period answered in writing the following questions, practically identical with those used by Hollingworth (36):

1. Did you go to bed at the usual hour last night?
2. Were your evening occupations of the usual sort?
3. Did you sleep as well as usual?
4. Did you get up at your regular time?
5. Have you taken your regular amount of exercise today?
6. Did you eat your regular meals today?
7. Have you had any digestive disturbance today, or any other physical disturbance?
8. Have you experienced any emotional disturbance today? Irritation? Worry? Pain? Anger? etc.
9. Have you suffered in any way during the last 24 hours?
10. Have your last 24 hours been in any way unusual?
11. Note beginning of menstruation.
12. Note end of menstruation.
13. Note any abnormal physical or mental symptoms.

Many of these questions had only a remote bearing on motor efficiency and were asked merely to assemble such information as to unusualness of habits of living as might influence scores and also to divert attention from the questions on menstruation. Questions 11, 12 and 13 were, of course, eliminated from the men's questionnaires.

This study does not intend to go into the psychological side of the question. It limits itself strictly to the matter at hand, namely, whether during menstruation there is any change in efficiency and skill in sports. Analysis of these replies is, however, of interest.

All the students led the usual normal college lives and attended the usual college concerts and dances. Only two events occurred during the test periods which might have been expected to disturb the scores. On October 26, 1925, six days after Group 1 began its tests, a serious automobile accident occurred in which a fraternity brother and a sorority sister of two of the subjects were killed and several others badly injured. On October 26th, 27th, and 28th, these subjects recorded great emotional excitement and grief. Scores in the general motor ability test on these days show a dip, i. e., a lessening of speed of performance. However, this dip in the man's score, M5, is less than the score of preceding days. In the girl's record, N2, she reaches her worst level, although preceding days were almost as bad. It may be possible that this emotional excitement caused this second low level of efficiency.

The second event which might have been expected to exert an influence on results was the period of mid-semester examinations, which extended over six days from January 25th to January 31st, 1926. During this period all of the subjects recorded

unusual hours of sleep and some worry. Although the students reported for their testing directly before or after examinations, analysis of their scores would not indicate any lessening of skill or speed due to worry or mental fatigue. Examination days could not be in any way differentiated from normal days by their scores.

Questionnaire Replies from Group 1, Designated Hereafter as N1, N2, N3, etc. Critical periods are starred

Subject N1, Freshman Age 21	October 21	Headache.
	October 30 (One period recorded)	Stiff muscles and sore left leg.
Subject N2, Sophomore Age 20	October 26-28	Great excitement and grief at accidental death of friend. Saw the auto accident.
	*November 9	Cramps. Said it was an unusual condition.
	November 24	Worry about History examination.
Subject N3, Junior Age 22	November 6	"A bit shaky. Up late last night."
	November 5, 10, 11, 12, 13	Worried over animal experiment in laboratory.
	November 23	"Hiked 17 miles on November 22. Slightly stiff."
	March 1, 2, 3, 1926	Sore throat and severe cold.
	This subject lived in the girls' dormitory. Her sleeping hours were very erratic. Many night parties.	
Subject N4, Sophomore Age 20	October 19-20	"Headaches and digestive disturbances."
	*November 8	(Sunday) Dull pain. Unusual.
	*December 7, 8	Dull pain. Unusual.
Subject N5, Graduate Age 21	(One period only.) Sleeping hours erratic, as in the case of Subject N3. Lived in same dormitory and was a friend of N3.	
Subject N6, Non-College Age 17	November 19	"Sore hands, could not grip."
	December 3	Turned ankle.
	December 4	Digestive disturbance.
	*December 10	Unusual slight dysmenorrhea at night.
	December 14	Hurt toe.
	February 2, 22	Leg ache. (Too much dancing.)
	*March 8	Absent with sore throat and severe headache.

Questionnaire Replies from Group 2, Designated Hereafter as AB1, AB2, AB3, etc. Critical periods are starred.

Subject AB1, Freshman Age 18	January 11 *February 26	(One period only) Backache. Slight cramps at night.
Subject AB2, Junior Age 21	January 7, 8 *January 12 *February 13	Excessive tiredness due to Life Saving Tests. Dull and very tired. Slight pain for some hours at beginning of period.
	February 2	Indigestion.
Subject AB3, Junior Age 19	*January 24 March 1	Pain for some hours. Emotional excitement.
Subject AB4, Sophomore Age 18	*January 20 February 1, 2 February 23	Severe dysmenorrhea. Pain due to bruised knee. Absent from school with severe pain and headache. No flow until February 24.
Subject AB5, Freshman Age 18	*January 14 January 19, 21 January 25, 28 February 23	(One period only). Excessive tiredness. Severe cold and chills. Sprained ankle. Swollen and sore. Turned ankle again.
Subject AB6, Freshman Age 17	*January 14 February 2 *February 11 March 4, 5	Cramps at night. Infected finger. Felt very dull, heavy and slow. Cold and sore throat.
Subject AB7, Freshman Age 21	*January 7 *February 3, 4 *March 2	"Slight cramps. Felt very tired." Cramps for two days almost continuously. Moderate to severe. Moderate cramps for several hours.
Subject AB8,	*January 16 *February 11	Nervous and slight cramps. Moderate cramps lasting for a few hours.

Questionnaire Replies from the Men, Designated Hereafter as M1, M2, M3, etc.

Subject M1, Freshman Age 18	January 19	"Cold in head."
Subject M2, Freshman Age 18	January 8 January 15 January 19 January 27 February 12	Cold. Turned ankle. Cold in head. Cold. Headache.
Subject M3, Junior Age 21	November 2, 16	Headache.
Subject M4, Freshman Age 19	March 8, 9	Sprained ankle. Considerable pain. Unable to take soccer test.
Subject M5, Junior Age 21	October 26, 28 November 9 December 15, 16	Nervous and excited due to auto accident. Unusual anger. Sore throat.

The replies thus recorded failed to yield any definite results, except in certain of the cases when some mechanical defect as a sprained ankle or sore hand limited the usefulness of that part.

As the following charts in Chapters 4, 5, and 6 show, even critical periods in the abnormal group which were accompanied by pain and discomfort, are not apparent, and were it not for the identification stars, they could not be distinguishable from the records of normal days. Such depressions as occur during critical periods apparently are no greater than those occasioned by chance variations. This coincides with the views held by Hollingworth (36), Moore and Barker (50), and Moore and Cooper (49).

CHAPTER III

THE MOTOR ABILITY TESTS USED

In planning any experiments using tests, Nichols (61) says it is essential they possess certain characteristics, namely: (1) They should be concrete, simple, and interesting; (2) They should be student-proof; (3) They should conform to the average facilities of time, space, and equipment; (4) They should be easily administered and measured; and finally, (5) They should be given always under the same conditions, in the same order and by the same person, with the same time intervals between the series. In other words, they should be given under uniform conditions to produce uniform, measurable results.

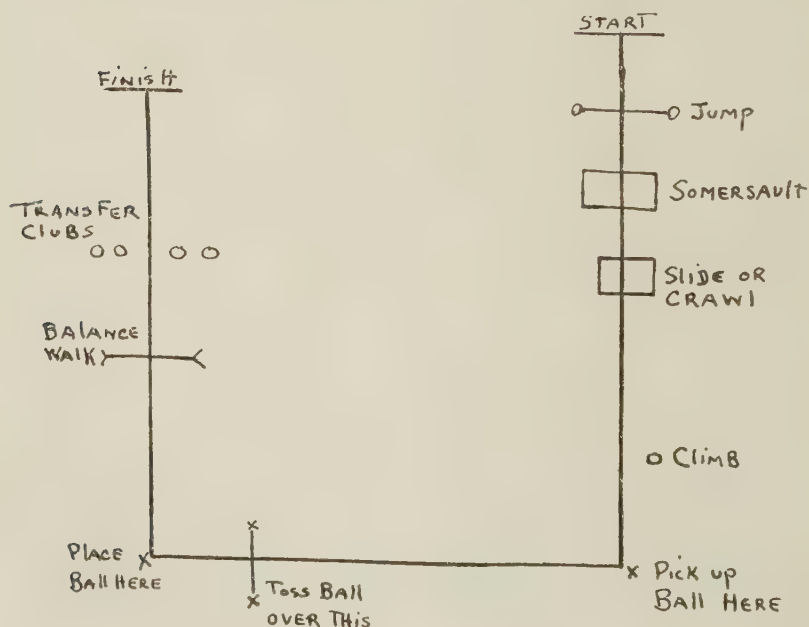
The tests chosen for this experimental study conformed to these principles. They were of particular interest to the students because they provided practice in one or more of the important elements of the actual games participated in by the students during the school year. This interest was maintained throughout the weeks and was stimulated by spontaneous competition and rivalry among the subjects, who constantly compared their results and strove to better their averages.

The tests were based on big muscle activities, using also in many cases the smaller accessory muscles of the arm, fingers, foot and eye. They included three time events, the soccer and basketball dribble and the general efficiency test, which measured speed and agility as well as co-ordination; one strength test measured by the hand dynamometer and two tests of skill and co-ordination, namely, the volleyball serve and the baseball throw. Tests were given indoors, every day except Saturday and Sunday, for a period of nine weeks (45 records) for each of the two groups tested. Each subject took her test at the same hour each day and was tested by the same person. Everything possible was done to eliminate disturbing or unusual factors.

Test No. 1. The General Motor Ability Test

The general motor ability test used with Group 1 (5 normal girls and 2 men) combined elements of running, jumping, climbing and throwing and so served as an excellent all-round efficiency test. Unfortunately, the apparatus for the continuance of this particular test was not available after January, when Group 2 began their testing. This test was adapted to local needs from the Halsey-Brown test described by Collins and Howe (22). A description of it with a diagram of the floor plan, showing the location of the apparatus, follows:

1. Crouch start at starting line. Fingers and toes behind the line.
2. Run 20 feet to a pair of jump standards across which a line is stretched two feet high. Clear this height.
3. Run 20 feet further to a gymnasium mat. Somersault on it or get both shoulders flat on the mat.
4. Crawl, slide, or dive under a table 15 feet further from the mat. Table is two feet, two inches high.
5. Run 12 feet to climbing rope. Climb to touch a ribbon tied on the rope nine feet above the end of the rope.
6. Run 13 feet further and pick up a volley ball.
7. Run with ball 22 feet and toss it over a cord stretched between a second pair of standards, eight feet high. Catch the ball on the other side of the rope. Run with it 12 feet and place it on the floor at mark.
8. Run 17 feet to boom. Walk from end to end on balance beam (lower boom), without using hands to aid in balancing.
9. Run 10 feet further to three Indian clubs, which must be transferred from one circle to another four feet away in the same line. Transfer one by one, and place upright.



10. Sprint for the finish line, 40 feet away.

Time is taken with a stop watch from the beginning to finish. No trial allowed. Knocking the clubs down necessitated a new trial, as did missing the ball, etc.

Test No. 2. A Basketball Position Dribble Test (Brace)

The basketball test involved the small accessory muscle groups and called for quick deft movements and co-ordination. It gave practice in one of the important elements of the game of basketball, namely, the dribble. The test was taken by three girls and two men of Group 1, and eleven girls and three men of Group 2, which number included three girls of the first group who had continued through the second period of tests.

1. Object: To test reaction time in a controlled dribble.
2. Equipment: A standard basketball, tightly inflated; smooth floor, stop watch and score pad.
3. Procedure: The subject stands, holding the ball in both hands. On the signal, "Go," the ball is bounced by one hand at the feet of the player. He continues to dribble the ball in place 15 times without moving more than necessary to keep the ball in control. The ball must be bounced at least 18 inches high. Time is taken from the moment the first bounce hits the floor until the 15th bounce hits. The subject should be instructed to continue dribbling until told to stop. A practice dribble is allowed.
4. Scoring: The score is the total elapsed time, taken by a stop watch, from the moment the first bounce hits, to and including the 15th bounce.

Test No. 3. Soccer Football Test (Brace)

The soccer football test was a speed event employing the smaller foot muscles and requiring skill and dexterity in dribbling the ball, i. e., carrying the ball down the field around objects with short controlled kicks. It was used with three girls and two men from Group 1, and eleven girls and three men from Group 2, including three girls from Group 1 mentioned above.

1. Object: To test the ability to dribble the ball around obstacles.
2. Equipment: Standard soccer football, tightly inflated; a smooth floor, four Indian clubs, stop watch and scoring blank.
3. Procedure: The four Indian clubs are arranged in a row, 10 feet apart. (See diagram). A starting line is drawn three feet from the first club. The player stands with the ball on the starting line. At the signal "Go," the player kicks the ball past the first club on the right, past the second club on the left, the third club on the right and around the last club, weaving in and out in a figure eight back to the starting line. If a club is knocked down, a new trial is taken. One trial is taken at the beginning of the experiment.
4. Scoring: The score is taken by a stop watch and is the time from the moment the ball is first moved to the moment it recrosses the starting line.



Test No. 4. Volleyball Serve

(Playground and Recreation Association)

The volleyball serve was a throwing event for accuracy of arm and hand movement. It involved the principal element of the game of volleyball. It was applied to three girls and two men of Group 1, and to eleven girls and three men of Group 2 (including three girls from Group 1).

1. Object: To test the ability to serve a volley ball over a net into a given space.
2. Equipment: A standard volley ball, tightly inflated; a smooth floor, a standard volley ball net, stretched between two standards with upper edge of net eight feet from the floor; a scoring blank.
3. Procedure: The player stands with both feet behind a line drawn parallel to the net and 24 feet distant. She faces the net, tosses the ball up with one hand and strikes it with the open palm or hand, so that the ball falls over the net into a rectangle drawn on the floor, 10 feet out from the net and extending 20 feet parallel with the net. Three trials are allowed. Maximum score possible is five points.
4. Scoring: One point is scored for every ball which lands in the rectangle. Five shots are given.

Test No. 5. Indoor Baseball Throw

(Playground and Recreation Association)

The indoor baseball throw was chosen because it is one of the commonest types of motor tests. It involves accuracy of arm motion and eye training. This test may be given with the simplest type of target, as is used here, or more complex targets, much like rifle targets, on which every place has a different value.

1. Object: To test the accuracy and skill of a player in hitting a target with a baseball.
2. Equipment: Standard 12 inch indoor baseball; a target 15 inches by 24 inches made of canvas, which is suspended in front of a gymnasium mat so that its lower edge (the base of the rectangle) is 24 inches from the floor; scoring pad.
3. Procedure: The player stands behind a line drawn 25 feet from the target. She may step forward as she throws, provided she does not step over the line. Either underhand or overhand delivery is permitted. Three trials are allowed and 10 shots.
4. Scoring: One point is awarded for every hit. Maximum score is 10 points. No points are scored when the ball hits the target on a bounce or rebound.

Test No. 6. Hand Dynamometer

The hand dynamometer as a measure of muscular strength has long been in use by physical educators and physiologists. Many types have been used to test various muscles of the body, such as the forearm, back, chest, etc. They all estimate the force of a single muscular contraction and use these figures as bases for conclusions as to muscular power.

Jacobi (39), as far back as 1876, writes about her experiments with the dynamometer and says the dynamometer test is influenced by skill force of hand and wrist muscles, not always proportionate to the rest of the body, and influenced by the most transient condition of health. She finds a lessening of strength during the menstrual period.

Peakes (44) in his intensive study on periodic variations of strength due to influences of weather, temperature, humidity, time of day, and other environment factors, finds stationary periods of development in adults from December to March, due to inclement weather. He considers "the dynamometer test for variations in physical ability an excellent means for judging the growth and development of physical strength."

Mosher and Martin (57) use the dynamometer in their study of the muscular strength of college women. Martin (45) makes the assertion that strength in adult women is correlated with alertness of mind and not muscular development and says that the average strength of 45 college women, as determined by Mosher and Martin, was approximately 50 per cent greater than 116 women factory workers, notwithstanding the fact that the factory workers performed heavier manual labor. Men, on the other hand, he finds, show a correlation between strength and the physical demands of their occupations. No correlation between strength and weight was found in adults, although it was in children. Martin considers the dynamometer tests of value in the industrial field as a means of estimating industrial fatigue.

There seems to be a general opinion among physiologists, however, that strength tests do not give any reliable index to the efficiency of the entire body. The dynamometer was used in this study, largely as a measure of local strength, and as a simple means to stimulate interest in the tests as a whole.

In this study the dynamometer test for right and left hand was given directly at the close of the test period to each individual. Thus records of 14 girls and five men were collected. Three of these girls have records of 90 days, the rest of 45 days. No trials were given, and the test was always given at the conclusion of the period.

1. Object: To measure forearm strengthen or grip.
2. Equipment: One Smedley hand dynamometer; scoring pad.
3. Procedure: The subject placed the dynamometer in her hand and squeezed it as hard as possible, being careful not to touch her side in the process. Right hand grip always taken first.
4. Scoring: Scores were read in pounds from the dial and recorded on blanks.

CHAPTER IV

MOTOR TESTS OF SPEED AND ABILITY

In analyzing the following tables and charts showing results of motor tests, it is well to keep in mind that, according to the opinion of experts already expressed in this study, we should expect to find marked indications of impaired efficiency of movement, skill and speed during menstrual periods. This experimental study, however, fails to bear out this supposition.

There were used, for purposes of study and comparison, three distinct groups of subjects, namely, the N group of normal girls, the AB group of so-called abnormal girls and the M group of men controls.

The experiment included three speed tests requiring agility and rapid bodily co-ordination—the general motor ability test, the soccer dribble and the basketball position dribble.

The general test will be analyzed first. It was applied to Group N and to two controls. It was later discontinued because the apparatus necessary for testing purposes was unfortunately no longer available.

Table 1 gives the daily record of the N group and the control, M5, with corresponding dates of performance. Critical periods are indicated on this and subsequent tables by stars (*). Four of the critical periods on this table show an increase of efficiency on the first days of the menstrual periods, four do not, while one period cannot be judged as it coincides with the first day of the test period.

Curves plotted from these daily records of the general test as well as certain other tests indicate clearly not only the learning process involved, but the great daily variations which are always present in motor or mental tests and which may be due to any number of reasons, such as fatigue, excitement, temporary lack of interest, or what not. These fluctuations are beyond the control of ordinary test conditions. Since they are present in the daily records of the men subjects as well as the women, they cannot be attributed to menstruation. Inspection of these charts, Numbers 1 and 2, shows that, were it not for indicating lines, it would be impossible to distinguish critical days from normal days, so variable are the records, and so often are depressions shown on normal days which are as great or greater than any depressions which chance to fall in critical periods. Chart 2, for instance, indicates a tremendous dip on October 26th and 27th in the soccer test for Subject N2, occasioned, probably, by emotional excitement caused by the automobile accident mentioned previously. This depression, however, is not apparent in her left hand dynamometer reading and only slightly so in her

CHART I GENERAL MOTOR ABILITY TEST (HALSEY-BROWN) N GROUP

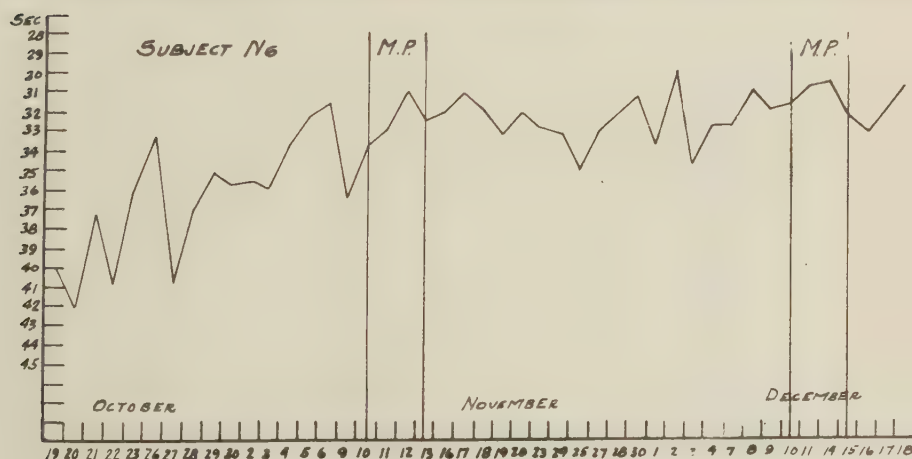
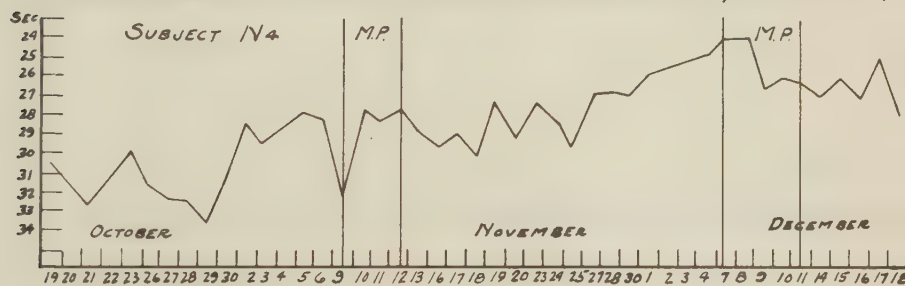
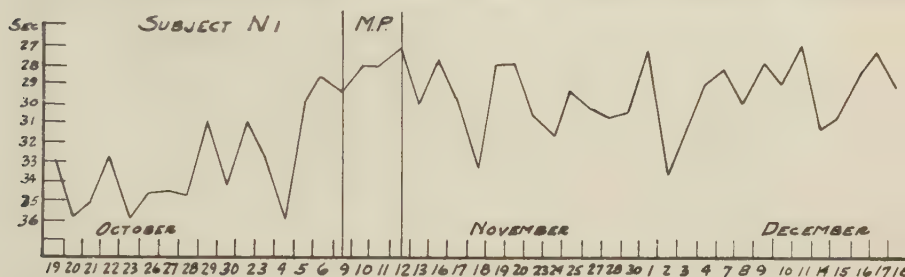
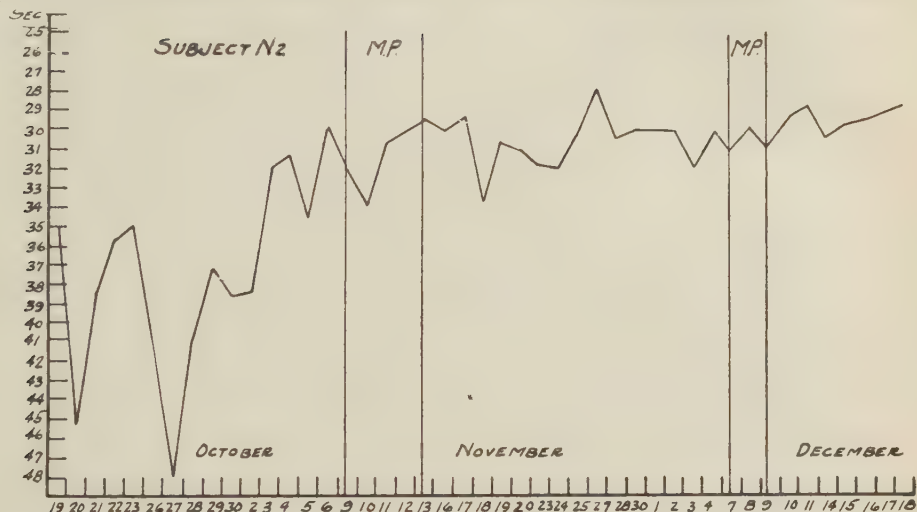


CHART II GENERAL MOTOR ABILITY TEST (HALSEY-BROWN) N GROUP





right hand. Curves on Chart 1 for Subjects N1, N4, and N6 show likewise greater depressions during normal days, without any apparent reason, than are indicated on critical days or just before menstrual periods.

Examination of the subsequent charts fails to establish clearly whether there is a regularly recurring period of maximum efficiency or not. Certain curves show a tendency towards a rhythm of efficiency every two or four days apart, but this rhythm is also apparent in the records of the men. It is not at any time clearly defined or easily explainable. This coincides with the findings of Hollingworth (36) who also reports that the period of greatest efficiency in certain of her tests falls on or just before the first day of the menstrual period.

Table 2, based on Hollingworth's method of computation, a method also recommended by Thorndike, shows individual variation of the group. This procedure minimizes the effect of practice and such other factors as might influence the final scores.

The method of computing this multiple of the mean variation, used in Tables 2, 4, 6, 8, and other even numbered tables, is as follows: Each record was reduced by first figuring the variation of each individual at each trial from the average of the group at that trial. These individual variations were then divided through by the mean variation of the group. For instance, the trials for the N group of the General Motor Ability test on October 19th were as follows:

N1.....	33	seconds
N2.....	35	seconds
N4.....	30.6	seconds
N5.....	38	seconds
N6.....	40	seconds

These figures, averaged, give 35.3 seconds as the average performance of the group as a whole. The variation of each subject from this average was then figured and found to be:

N1.....	-2.3	seconds
N2.....	-0.3	seconds
N4.....	-4.7	seconds
N5.....	+2.7	seconds
N6.....	+4.7	seconds

The minus sign signifies a better score than the group average and the plus sign a worse score, in all speed events. These variations were then averaged and the mean variation of the group was found to be ± 2.94 . Using this mean variation to divide each individual variation, the final result, the multiple of the mean variation of the group, was obtained.

This procedure was carried through for each day of the 45 test periods. The next step was to choose, for purposes of comparison, the six days immediately preceding and the six days

immediately following each menstrual period and the four days during each period for each subject. Two such separate periods of 16 days each for each subject were used. Four days during menstrual periods were used because the majority of subjects had critical periods of this length. Critical days of each subject were placed in central columns, one below the other, with the two six day periods running out from either side of the center column. The next step in the statistical procedure was to add each column algebraically and to find the average efficiency of the group at each trial. Tables 2, 4, 6, 8, etc., give the results of this computation.

An examination of Table 2, the general test, shows that seven out of the 32 normal days of the two periods studied were the same as or poorer than the group average on the critical days. Hence we may say that this test showed no evidence of characteristic inefficiency during menstrual periods. Other mean variation tables bear out this same conclusion.

Table 3 gives the daily record of the three groups tested in basketball position dribble. In the N group increased efficiency seems apparent on the first menstrual day in 7 out of 10 critical periods, while in the AB group first days show an increase in 7 out of 15 menstrual periods under observation. Charts 3, 4, and 5, following this table, show the basketball and soccer results for 90 days for N3, N4, and N6. It will be seen that the practice curve for the soccer dribble is much more pronounced than the curve for the basketball dribble, particularly in the case of Subjects N4 and N6. Fluctuations from day to day are quite marked and menstrual periods do not appear as times of particular inefficiency.

Charts 6 and 7 give the 45 day record of eight AB subjects in the basketball test and are self-explanatory.

Table 4 gives the mean variations of the basketball test in similar periods of 32 days as previously explained. Eleven of the normal days of the N group were just as poor as or poorer than menstrual days, while 12 of the normal days of the AB group were as poor as or poorer than the menstrual days.

Table 5 gives the daily records of the soccer test. Inspection shows that the N subjects showed increased efficiency on seven first days of eleven menstrual periods, while the AB group record showed seven higher efficiency days out of 15 periods.

Table 6 shows that in the N group six out of 24 highly efficient normal days and seven out of 24 normal days in the AB group were as poor as or poorer than critical periods.

Charts 8, 9, and 10 give a clear picture of 45 days' records of the AB group in soccer. In certain subjects the first day of the menstrual period showed a depression, i. e., a slowing up of speed; in others, it showed an increased efficiency of movement.

CHART N° III

SUBJECT N3



DAILY RECORD FOR 30 DAYS

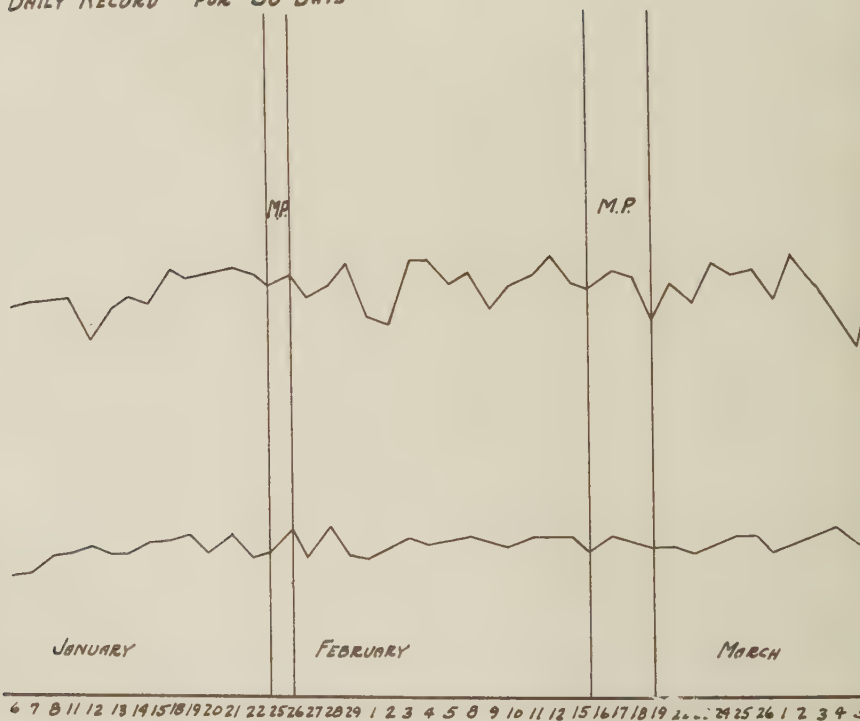


CHART N^o IV

SUBJECT N^o 5



DAILY RECORD FOR 90 Days

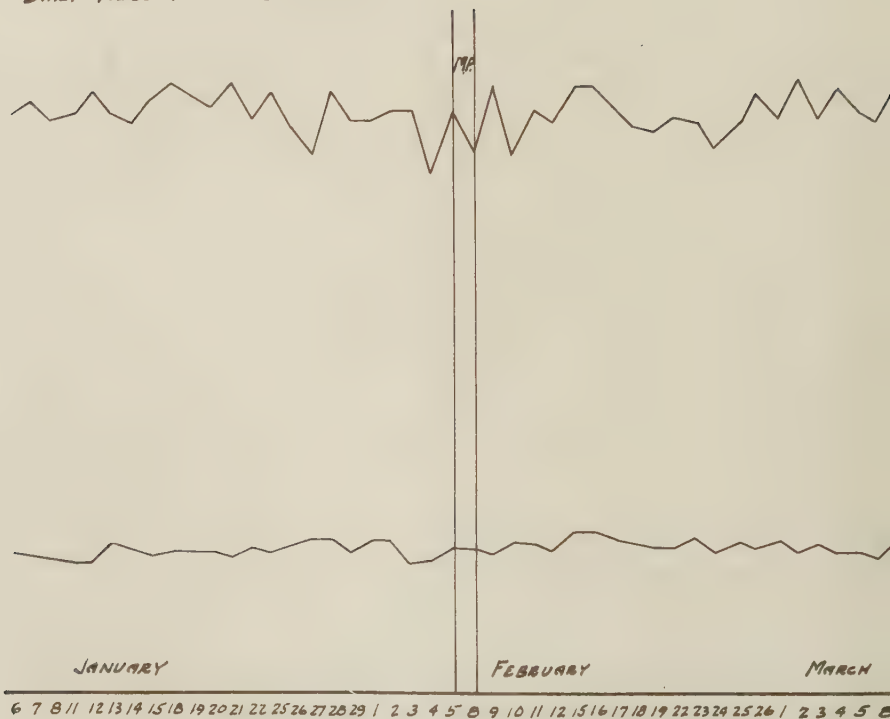


CHART N° V

SUBJECT N°6

SOCCER DRIBBLE

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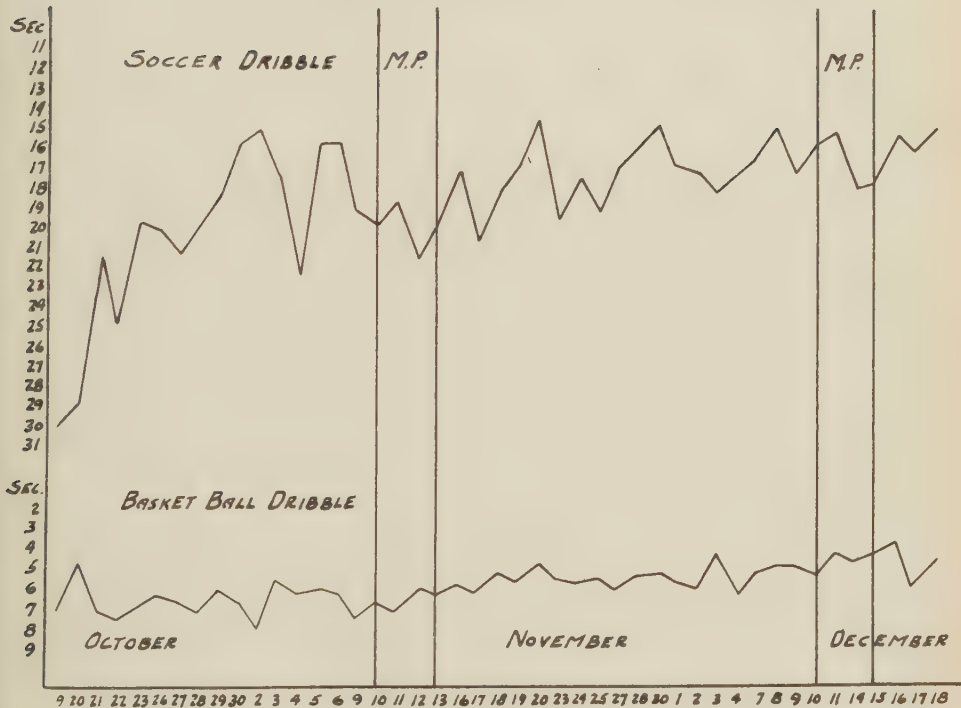
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BASKET BALL DRIBBLE

OCTOBER

NOVEMBER

DECEMBER



DAILY RECORD FOR 30 DAYS

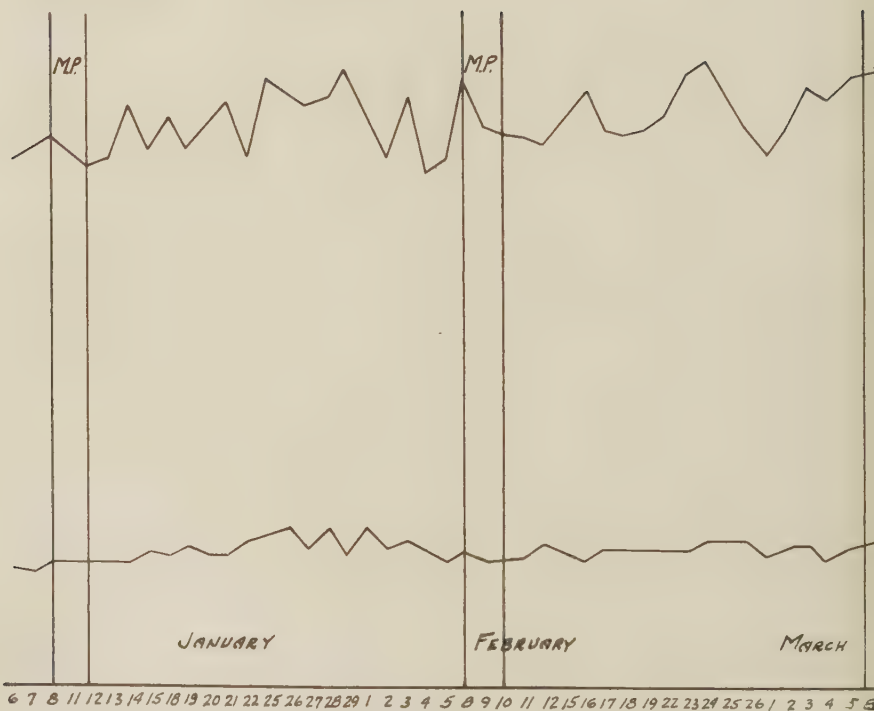
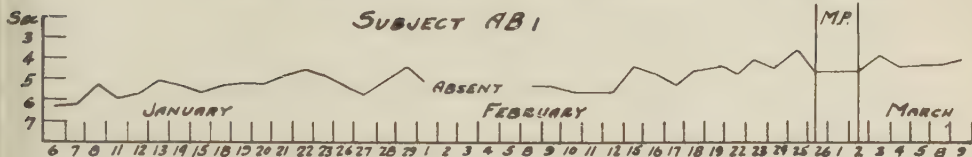
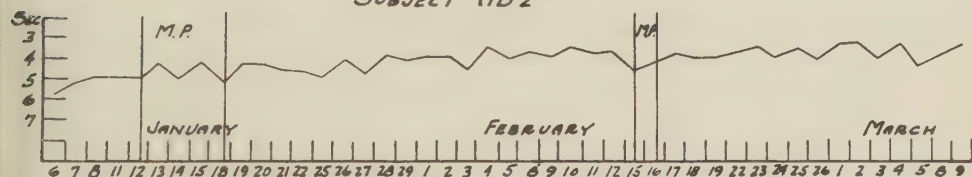


CHART VII BASKET BALL DRIBBLE AB GROUP

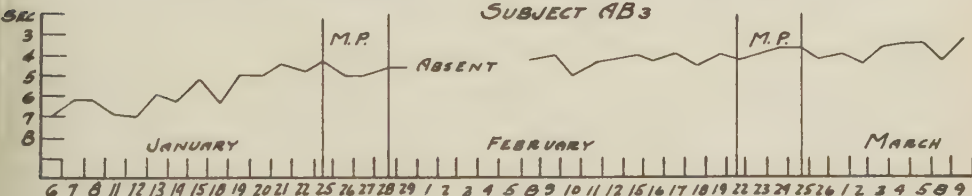
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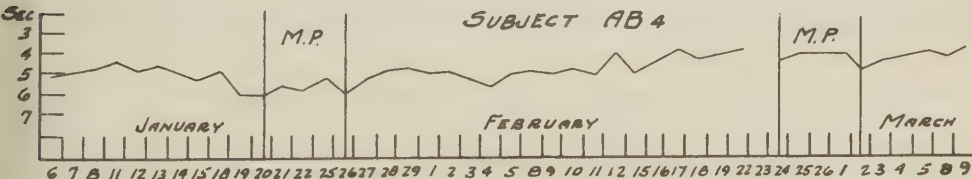
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SUBJECT AB3



SUBJECT AB4



SUBJECT AB5

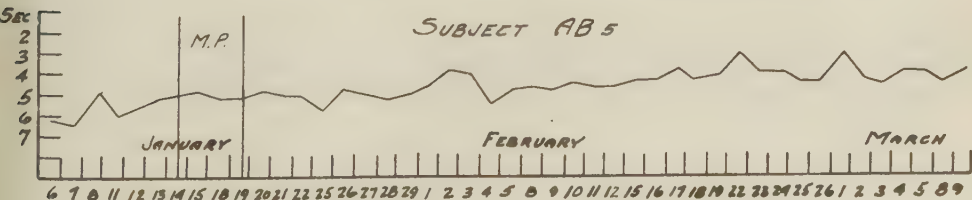
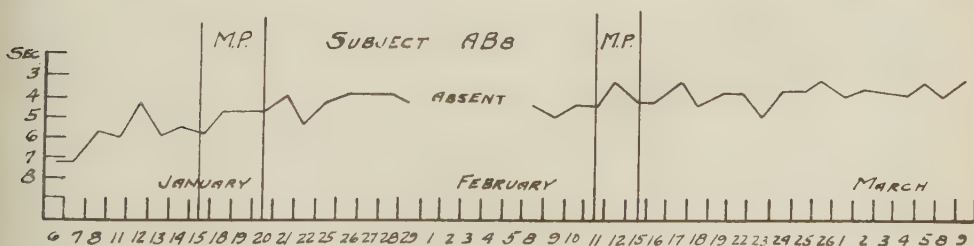
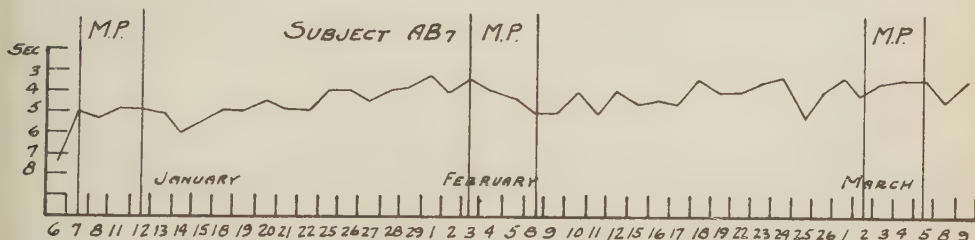
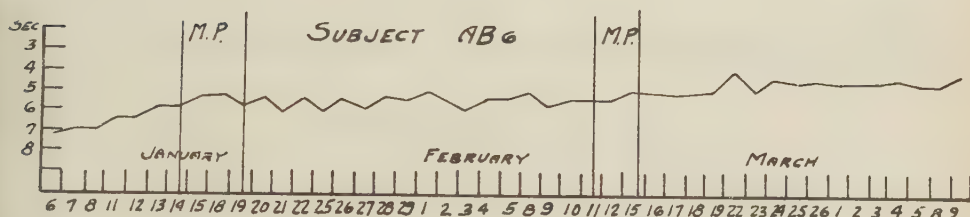


CHART VII BASKET BALL DRIBBLE AB GROUP



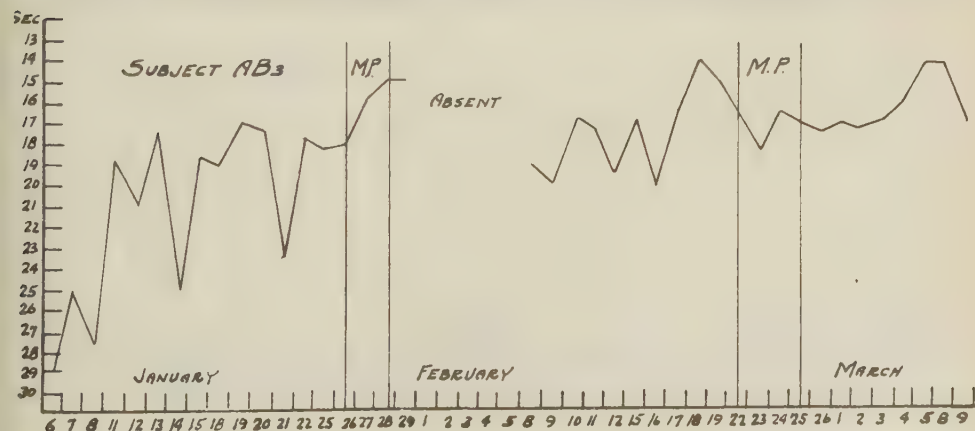
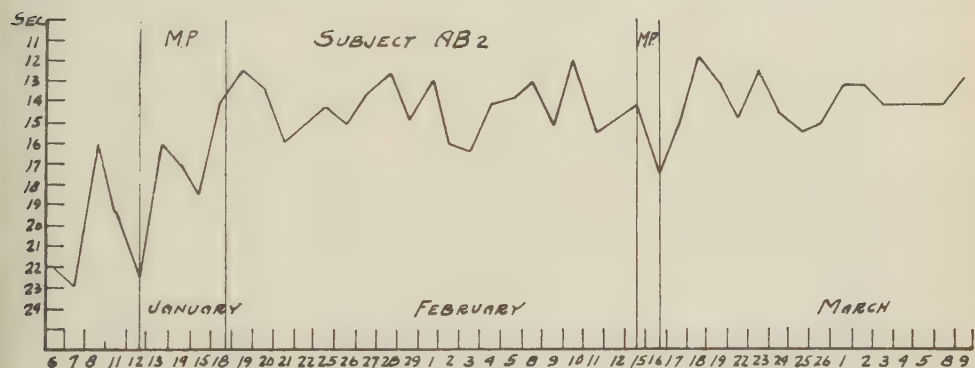
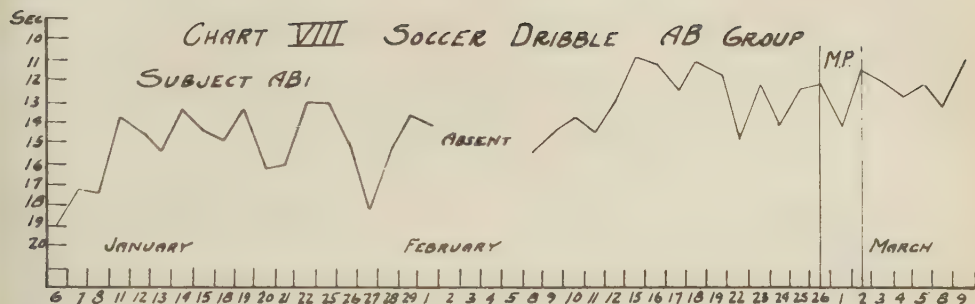


CHART IX SOCCER DRIBBLE AB GROUP

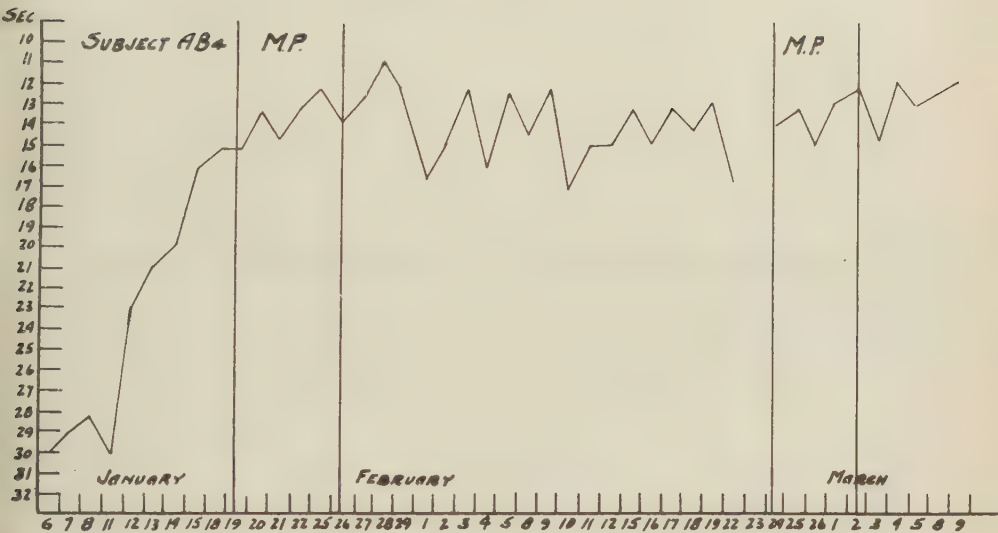


CHART X SOCCER DRIBBLE AB GROUP

SUBJECT AB6

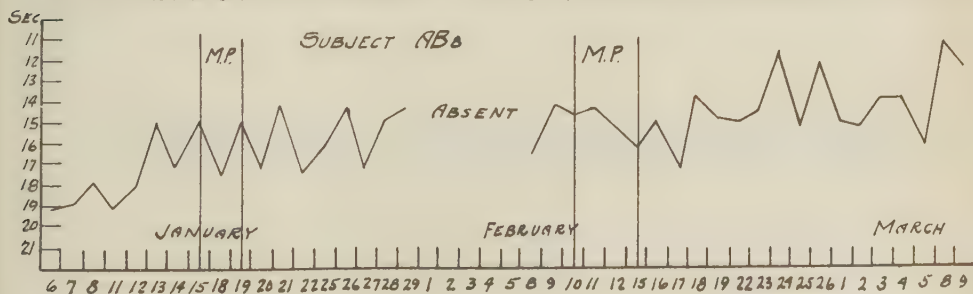
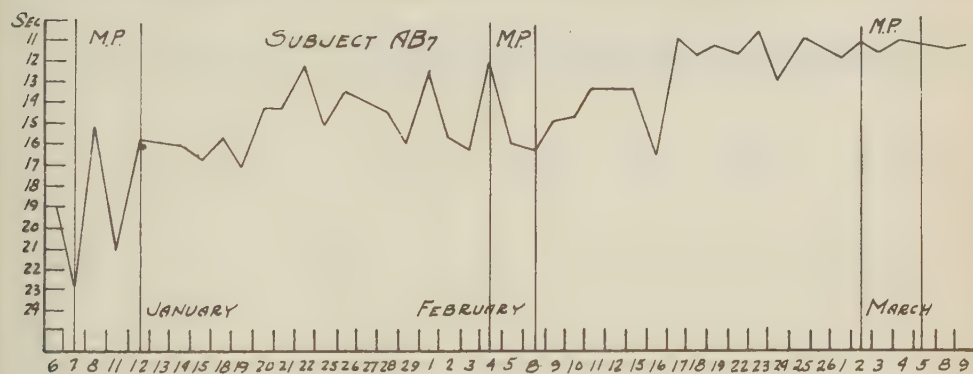
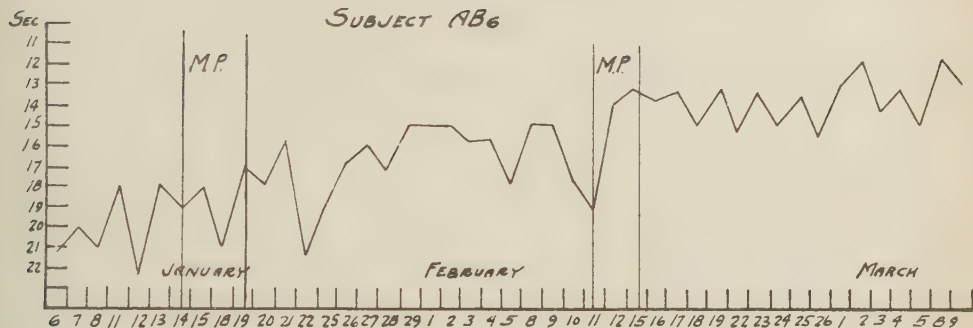


CHART II COMPOSITE CURVE BASKET BALL DRIBBLE - MEN

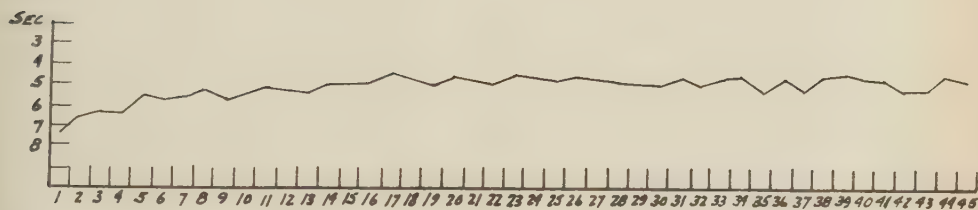


CHART COMPOSITE CURVE SOCCER DRIBBLE - MEN



No uniformity of result was apparent, and since these same variations tended also to be found in the control records, menstruation, as such, could not be termed the cause. The appearance of peaks or depressions during first days or during any part of the menstrual periods appears to be largely a matter of chance without physiological reason.

Chart 11 presents a composite picture of the men's records for 45 days. This curve will naturally tend to be somewhat smoother than individual curves. It was not possible to prepare composite charts of the women's records, although they would be highly desirable, because dates of menstrual periods did not coincide in the group. In order to bring these critical days within the same period of dates, it would be necessary to either shorten or lengthen the intervening period of days. This would introduce the element of practice and it is obvious that the scores nearer the close of the 45 day practice period would be far better than the beginning scores. This would, therefore, affect the composite curves and they would not be absolutely accurate. Had it been possible to extend these experiments over a much longer period of time, the first few weeks of records could have been discarded and only the later, more stable records could have been used. It is interesting to note that this practice effect is not very pronounced in either the baseball or volleyball tests, and that the scores at the end of the 45 day test period are not much better than those made at the beginning.

TABLE 1

Daily Record of the General Motor Ability Test

Time required to complete the general test, requiring agility, speed and general bodily co-ordination. Menstrual periods indicated by a star (*).

Date	October 19, 1925, to December 18, 1925				
Day	N1	N2	N4	N5	N6
1	33.0	35.0	30.6	*38.0	40.0
2	36.0	45.4	31.8	*39.0	42.2
3	35.2	38.4	32.8	*35.8	37.4
4	32.8	35.8	31.4	*33.4	41.2
5	36.0	35.0	30.0	31.6	36.2
6	34.8	41.2	31.8	35.0	33.2
7	34.6	48.0	32.6	34.0	41.0
8	34.8	41.0	32.6	31.4	37.2
9	31.0	37.2	33.8	29.0	35.2
10	34.4	38.6	31.4	29.4	36.0
11	31.0	38.4	28.6	27.6	35.8
12	32.8	32.0	29.6	32.6	36.0
13	36.0	31.4	28.8	26.0	33.8
14	30.0	34.6	28.0	26.4	32.4
15	28.6	30.0	28.4	25.6	31.8
16	*29.2	*32.0	*32.4	25.0	36.8
17	*28.0	*34.0	*27.8	26.2	*33.8
18	*28.0	*30.6	*28.4	25.0	*35.0
19	*27.2	*30.0	*27.8	25.0	*31.0
20	30.0	*29.4	29.0	25.8	*32.8
21	27.8	30.0	29.8	25.4	32.2
22	29.8	29.4	29.2	26.8	31.2
23	33.4	33.8	30.2	28.2	32.0
24	28.0	30.6	27.4	27.4	33.4
25	28.0	31.0	29.2	27.2	32.2
26	30.8	31.8	27.4	28.8	33.0
27	31.8	32.0	28.4	27.4	33.4
28	29.2	30.2	29.8	27.6	35.4
29	30.2	28.0	27.0	26.0	33.2
30	30.6	30.4	26.8	26.8	32.4
31	30.4	30.0	27.0	26.0	31.4
32	27.2	30.0	26.0	26.0	34.0
33	33.8	30.0	25.6	25.6	30.0
34	31.2	32.0	25.2	27.2	35.0
35	29.0	30.0	25.0	26.0	32.8
36	28.2	*31.0	*24.0	*26.0	32.8
37	30.0	*30.0	*24.0	*26.0	31.0
38	28.0	*31.2	*26.8	24.4	32.0
39	29.0	29.4	*26.2	28.0	*31.8
40	27.0	28.6	*26.4	27.0	*30.8
41	31.4	30.4	27.2	26.8	*30.6
42	30.8	29.8	26.2	28.0	*32.6
43	28.4	29.4	27.2	26.8	33.4
44	27.4	29.2	25.2	26.0	32.0
45	29.2	28.4	28.2	26.6	30.8

TABLE 2

The General Motor Ability Test

First Period

A record of each individual variation from the average, reduced to a multiple of the mean variation of the group, figured in six day periods before and after, and four day periods during menstruation.

+ = worse than the average.

— = better than the average.

N1	N2	N4	N5	N6	Algebraic sum	Average
+1.18	+1.67	—0.89	.....	+0.90	+2.46	+0.61
—0.55	+1.55	—0.90	.....	+1.44	+1.54	+0.38
—0.33	—0.77	—2.11	.....	+0.86	—2.35	—0.58
+1.60	+0.06	—0.80	.....	+0.80	+1.66	+0.41
—0.11	+1.65	—0.88	.....	+1.81	+2.47	+0.61
—0.19	+0.68	—0.31	.....	—1.81	—1.63	—0.40
*—0.56	*+0.31	*+0.43	*+0.91	*+1.13	*+2.22	*+0.40
*—0.31	*+1.34	*—0.79	*+0.05	*+1.81	*+2.10	*+0.42
*—0.45	*+0.72	*—0.27	*—0.04	*+1.55	*+0.51	*+0.10
*—0.55	*0.00	*—0.22	*—0.53	*+2.12	*+0.82	*+0.16
+0.37	+0.50	—0.25	—0.87	+1.60	+1.35	+0.22
—0.60	+0.27	+0.40	—0.08	+0.25	+0.24	+0.04
—0.63	+1.40	—0.09	—0.77	—1.95	—2.04	—0.51
+0.95	+0.61	—0.65	—1.30	+1.58	+1.19	—0.29
—0.61	+0.88	—0.90	—1.61	+1.94	—0.30	—0.05
—0.88	+0.88	—0.17	—1.60	+1.27	—0.50	—0.09

TABLE 2
The General Motor Ability Test

Second Period

+ = worse than the average.
- = better than the average.

N1	N2	N4	N5	N6	Algebraic sum	Average
.....	+0.42	-1.19	-1.14	+0.37	-1.54	-0.38
.....	+0.55	-0.95	-1.45	+1.58	-0.27	-0.06
.....	+0.53	-1.00	-1.00	+1.78	+0.31	+0.07
.....	+0.37	-1.25	-1.25	+1.57	+0.44	+0.11
.....	+0.61	-1.58	-0.93	+1.12	-0.78	-0.19
.....	+0.60	-1.40	0.00	+1.50	+0.62	+0.15
.....	.....	*-1.57	*-0.87	*+2.14	*+0.30	*+0.10
.....	*+0.92	*-1.68	-0.88	*+1.21	*-0.43	*-0.14
.....	*+0.72	*-0.66	.....	*+0.77	*+0.83	*+0.27
.....	*+1.16	*-1.86	.....	*+1.67	*+0.97	*+0.32
.....	+0.35	-1.11	-1.66	+2.31	+0.11	+0.02
.....	+0.92	-1.68	-0.57	+1.95	+0.62	+0.15
.....	+0.66	-0.94	-0.78	+1.25	+0.18	+0.14
.....	+0.21	-1.28	-1.34	.....	-2.41	-0.80
.....	+0.21	-0.91	-0.73	.....	-1.43	-0.45
.....	+0.61	.....	-1.15	.....	-0.54	-0.27

TABLE 3

Daily Record of the Basketball Position Dribble Test

Time required in seconds to make 15 position dribbles with the basketball.
Menstrual periods indicated by stars (*).

Date Day	October 19, 1925, to December 18, 1925			January 6, 1926, to March 9, 1926		
	N3	N5	N6	N3	N5	N6
1	9.4	*8.4	7.2	6.0	4.2	5.0
2	*9.6	*8.2	5.0	5.8	4.0	5.2
3	*9.2	*7.4	7.2	5.0	4.4	*4.4
4	*7.8	*7.4	7.6	4.8	4.6	*4.8
5	7.8	6.6	7.0	4.6	4.4	*4.8
6	7.0	6.8	6.4	4.8	3.6	4.8
7	7.6	7.2	6.8	4.8	3.8	4.8
8	7.6	6.2	7.2	4.2	4.2	4.2
9	6.8	7.0	6.2	4.2	4.0	4.6
10	8.4	6.0	6.8	4.0	4.0	4.0
11	7.4	6.2	8.0	4.8	4.0	4.4
12	6.4	6.0	5.8	4.0	4.2	4.4
13	7.2	6.0	6.4	5.0	3.8	3.6
14	7.2	6.4	6.2	*4.8	4.0	3.2
15	8.0	7.0	6.4	*3.8	3.6	3.0
16	6.4	7.2	7.6	5.0	3.4	4.0
17	7.0	5.8	*6.8	3.4	3.4	3.0
18	7.6	6.6	*7.2	4.8	4.0	4.6
19	6.2	5.6	*6.2	5.0	3.4	3.0
20	*6.8	6.0	*6.4	4.4	3.4	4.0
21	*6.2	6.0	6.0	4.0	4.6	3.6
22	6.8	6.0	6.4	4.4	4.4	4.0
23	6.8	6.2	5.4	4.2	*3.8	*4.8
24	6.0	6.8	5.8	4.0	*3.8	*4.2
25	5.6	5.8	5.0	4.2	4.0	*4.6
26	5.2	5.4	5.6	4.4	3.6	*4.6
27	5.6	5.2	5.8	4.0	3.4	4.4
28	5.6	5.8	5.6	4.0	3.8	3.8
29	5.8	5.2	6.2	*4.0	3.0	4.4
30	5.4	6.0	5.6	*4.6	3.0	4.6
31	5.4	5.6	5.4	*4.0	3.4	4.0
32	5.6	5.0	5.8	*4.2	3.6	4.0
33	5.6	5.0	6.2	*4.4	3.8	4.2
34	5.0	5.0	4.4	4.4	3.8	4.2
35	6.2	4.4	6.4	4.8	3.2	4.2
36	*6.0	*5.0	5.4	4.4	4.0	3.6
37	*5.2	*4.6	5.0	4.0	3.4	3.6
38	*5.0	4.0	5.0	4.0	3.8	3.6
39	*4.4	5.0	*5.4	4.8	3.4	4.4
40	*5.4	4.4	*4.4	4.4	4.0	4.0
41	5.0	5.0	*4.8	4.0	3.6	3.8
42	5.0	4.2	*4.6	3.6	4.0	4.6
43	6.0	4.0	3.8	4.4	4.0	4.0
44	5.0	4.0	6.0	4.8	4.4	*abs.
45	4.8	4.2	4.8	4.6	3.4	*3.6

TABLE 3
Daily Record of the Basketball Position Dribble Test
(Continued)

Date	January 6, 1926, to March 9, 1926							
Day	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8
1	6.4	5.8	7.0	5.2	6.2	7.2	7.4	7.2
2	6.2	5.2	6.2	5.0	6.4	7.0	*5.0	7.0
3	5.2	5.0	6.2	4.8	4.8	7.0	*5.2	5.8
4	5.8	5.0	6.8	4.4	5.8	6.4	*4.8	6.0
5	5.6	*5.0	7.0	4.8	5.6	5.8	*4.8	4.4
6	5.0	*4.4	6.0	4.6	5.2	*5.8	5.0	6.0
7	5.2	*5.0	6.2	5.0	*5.0	*5.4	6.0	5.6
8	5.6	*4.4	5.2	5.4	*4.8	*5.2	5.4	5.8
9	5.4	5.0	5.0	5.0	*5.2	*5.6	4.8	*4.8
10	5.2	4.4	5.0	6.0	*5.2	5.4	4.8	*4.8
11	5.2	4.4	4.6	*6.0	4.8	6.0	4.4	*4.8
12	4.8	4.6	4.8	*5.6	5.0	5.4	4.8	4.0
13	4.6	4.6	4.2	*5.8	5.0	6.0	4.8	5.4
14	4.8	5.0	*5.0	*5.2	5.8	5.4	4.0	4.4
15	5.4	4.2	*5.0	*5.0	4.8	5.8	3.8	4.0
16	5.8	4.8	*4.6	5.2	5.0	5.2	4.4	4.0
17	5.0	4.0	*4.6	4.8	5.2	5.4	4.0	4.0
18	4.4	4.2	4.2	4.8	5.0	5.0	3.8	4.4
19	5.0	4.0	abs.	5.0	4.6	5.4	3.2	abs.
20	abs.	4.0	abs.	5.0	3.8	5.8	4.0	abs.
21	abs.	4.6	abs.	5.2	4.0	5.2	3.4	abs.
22	abs.	3.6	abs.	5.6	5.4	5.2	*3.8	abs.
23	abs.	4.0	abs.	5.0	4.8	5.0	*4.2	abs.
24	5.2	3.8	4.4	4.8	4.6	5.6	*5.0	4.6
25	5.2	4.0	4.0	5.0	4.8	5.4	4.8	5.0
26	5.6	3.6	5.0	4.8	4.4	*5.4	4.0	4.6
27	5.6	3.8	4.6	5.0	4.6	*5.4	5.0	*4.6
28	5.6	3.8	4.4	4.0	4.6	*5.0	4.0	*3.4
29	4.4	*4.6	4.0	5.0	4.4	5.0	4.6	*4.2
30	4.6	*4.2	4.2	4.4	3.6	5.0	4.4	4.2
31	5.2	3.8	4.4	3.8	4.2	5.0	4.6	3.4
32	4.6	4.0	4.0	4.2	4.0	5.0	3.4	4.4
33	4.2	4.0	3.8	4.0	3.0	4.8	4.0	3.8
34	4.6	3.6	*4.2	3.8	3.8	3.8	4.0	3.8
35	4.0	3.4	*4.0	abs.	3.8	4.8	3.4	5.0
36	4.2	4.0	*3.6	*4.4	4.2	4.2	3.4	3.8
37	3.6	3.6	*3.6	*4.0	4.2	4.4	5.2	3.8
38	*4.4	4.0	4.2	*4.0	3.0	4.2	4.0	3.4
39	*4.4	3.4	4.0	*4.0	4.0	4.4	3.2	4.0
40	*4.4	3.2	4.4	*4.8	4.4	4.4	*4.0	3.6
41	3.8	4.0	3.4	4.2	3.8	4.6	*3.6	3.8
42	4.4	3.4	3.4	4.0	3.8	4.4	*3.4	4.0
43	4.2	4.2	3.4	3.8	4.2	4.6	*3.4	3.4
44	4.2	3.8	4.2	4.0	3.8	4.6	4.6	4.0
45	4.0	3.2	3.2	3.6	3.6	4.0	3.6	3.4

TABLE 3
Daily Record of the Basketball Position Dribble Test

Date Day	(Continued)			
	January 6, 1926, to December 18, 1925		October 19, 1925, to March 9, 1926	
	M5	M1	M2	M4
1	7.4	8.0	7.0	5.4
2	6.4	7.4	7.8	5.8
3	7.6	6.6	6.8	4.6
4	7.2	6.6	7.0	5.0
5	6.8	6.0	5.4	4.6
6	6.2	6.4	6.0	5.4
7	6.2	5.8	6.0	5.8
8	5.8	6.0	5.0	4.8
9	6.6	5.2	4.8	6.6
10	6.0	5.6	5.4	4.6
11	7.0	5.6	4.4	4.0
12	6.8	6.0	4.4	5.0
13	6.0	6.0	4.4	4.8
14	5.6	5.8	4.8	4.2
15	6.0	6.0	4.0	4.2
16	6.4	5.8	4.2	3.6
17	5.2	4.0	4.6	3.8
18	6.0	5.0	4.4	3.8
19	5.8	5.4	5.0	3.4
20	6.0	4.8	4.0	4.0
21	6.0	5.0	4.2	4.2
22	5.8	5.4	5.0	4.2
23	5.6	5.6	4.4	4.4
24	5.4	4.8	5.0	4.4
25	5.8	5.0	4.0	3.8
26	4.2	5.2	4.0	4.0
27	6.2	4.8	4.4	4.4
28	6.0	5.2	4.2	4.2
29	7.0	5.2	4.4	4.4
30	5.6	4.2	4.4	3.8
31	5.0	5.4	4.4	3.8
32	5.8	4.4	4.8	3.8
33	6.0	5.4	4.6	3.8
34	5.0	4.8	5.0	4.4
35	6.0	5.6	5.0	3.8
36	5.8	4.0	4.4	3.4
37	6.0	6.4	4.2	3.8
38	5.4	5.0	4.0	3.8
39	5.2	5.0	4.2	4.2
40	6.0	4.2	4.4	3.2
41	5.8	5.4	4.2	3.8
42	5.6	6.2	5.0	abs.
43	6.2	5.4	4.2	3.8
44	4.6	5.4	4.4	3.8
45	6.6	4.4	5.0	3.8

TABLE 4
The Basketball Position Dribble
First Period

+ = worse than the average.
— = better than the average.

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Aver- age
.....	.....	0.00	-0.75	-0.43	+1.00	-1.00	+0.50	-0.68	-0.11
.....	.....	-0.50	-1.20	+0.25	+1.25	-1.50	+0.57	-1.13	-0.19
.....	-1.00	-0.25	-1.00	-1.16	+2.50	-1.75	-1.25	-3.91	-0.56
.....	-1.00	-0.75	+0.66	-0.29	+1.14	-3.25	+1.60	-1.89	-0.27
.....	-0.83	-0.25	+0.50	+0.25	+2.50	-0.66	-0.50	+0.01	+0.01
.....	-0.86	-2.00	+2.25	0.00	+1.20	-1.57	+2.00	+1.02	+0.15
*	* -0.50	* 0.00	* +2.75	* -1.00	* +1.00	* -1.12	* -1.50	* -0.37	* -0.05
*	* -1.60	* +0.33	* +1.75	* -1.33	* +0.66	* -1.00	* -0.75	* -1.94	* -0.28
*	* -1.00	* -0.60	* +2.00	* +0.50	* +1.50	* +0.75	* -0.25	* +2.90	* +0.41
*	* -2.66	* 0.00	* +0.40	* +0.25	* +1.25	.....	.....	* -0.76	* -0.15
.....	-0.50	-0.75	+0.60	-0.25	+1.25	0.00	-2.25	-1.90	-0.27
.....	-1.75	.....	+0.50	+0.25	+2.75	-1.40	+1.00	+1.35	+0.22
.....	-1.25	.....	+0.75	+2.20	+1.00	+1.60	-1.20	+1.10	+0.18
.....	-0.75	.....	+1.25	+0.60	+2.00	-0.66	-1.33	+1.06	+0.17
.....	-1.00	.....	+1.00	0.00	+1.00	+0.33	-1.80	-0.47	-0.08
.....	0.00	.....	+1.00	+0.20	+1.80	0.00	-1.50	+1.50	+0.25

TABLE 4
The Basketball Position Dribble
Second Period

+ = worse than the average.
- = better than the average.

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
+1.00	-1.50	-0.33	0.00	.....	+1.29	+0.66	.....	+1.06	+0.17
+0.30	-2.25	-1.66	-0.66	.....	+0.62	-1.00	.....	-4.45	-0.74
+2.60	-2.00	-1.00	-0.33	.....	+1.50	-1.66	.....	-0.89	-0.16
-0.20	-2.20	-0.33	-0.50	.....	+0.75	+2.40	.....	-0.08	-0.01
+1.00	-2.00	+0.33	0.00	.....	-2.00	0.00	-0.25	+1.08	+0.15
-0.80	-1.00	-1.50	.....	.....	+1.40	-1.50	+0.50	-2.90	-0.48
*+2.00	*	*+1.33	*+1.66	*	*+1.20	*-0.25	*-0.20	*+5.74	*+0.95
*	*	*-0.20	* 0.00	*	*+1.66	*-1.33	*-0.40	*+0.27	*+0.05
*+1.50	*+0.33	*-1.00	* 0.00	*	.....	*-1.33	*-1.66	*-2.16	*-0.36
*+0.75	*-1.00	*-0.80	*+0.50	*	*+1.66	*-1.33	*-1.00	*-2.22	*-0.31
-0.66	-0.66	+1.00	+0.66	.....	-3.00	+2.00	-1.00	+4.34	+0.62
+2.00	-1.00	+0.50	-0.66	.....	+1.16	0.00	+0.33	+0.67	+0.09
+1.33	-0.50	+0.75	0.00	.....	+2.30	.....	+0.33	+4.21	+0.70
0.00	-0.66	-1.33	-1.00	.....	+3.50	.....	-1.50	-0.99	-0.16
+2.00	-1.40	-1.33	0.00	.....	0.00	.....	0.00	-0.73	-0.12
.....	+0.33	-1.33	.....	.....	+1.40	.....	+1.80	+2.20	+0.55

TABLE 5

Daily Record of the Soccer Dribble Test

Time required in seconds to dribble the soccer ball around four Indian clubs. Menstrual periods indicated by stars (*).

October 19, 1925, to December 18, 1925				January 6, 1926, to March 9, 1926		
Date	N3	N5	N6	N3	N5	N6
1	20.0	*30.2	30.0	13.4	13.0	16.2
2	*20.6	*31.0	29.0	13.2	12.4	15.6
3	*20.0	*25.8	21.4	13.2	13.2	*15.2
4	*16.4	*27.2	24.8	13.0	13.0	*15.8
5	16.8	21.2	19.8	15.0	11.8	*16.6
6	19.4	21.2	20.0	13.6	13.0	16.2
7	19.4	15.0	21.4	13.0	13.4	13.6
8	16.8	17.2	20.0	13.2	12.2	15.8
9	15.8	14.8	18.4	11.6	11.4	14.2
10	15.8	14.2	15.8	12.0	12.0	15.6
11	17.2	12.8	15.2	11.8	12.6	14.4
12	15.0	12.8	17.4	11.6	11.4	13.4
13	14.6	15.0	22.4	11.8	13.2	16.2
14	14.4	15.0	15.8	*12.4	12.0	12.2
15	14.6	14.4	15.8	*12.0	13.8	13.0
16	17.4	14.4	19.2	13.0	15.0	13.6
17	16.2	14.0	*19.8	12.4	12.0	13.2
18	15.2	21.8	*18.8	11.4	13.4	11.8
19	15.2	15.4	*21.6	14.0	13.4	14.2
20	*15.0	14.0	*20.0	14.2	13.0	16.2
21	*14.0	15.8	17.2	11.2	13.0	13.2
22	14.0	15.4	20.8	11.2	16.0	17.0
23	13.0	15.0	18.2	12.2	*13.0	16.2
24	14.2	13.8	17.0	11.8	*15.0	*12.2
25	13.6	13.4	14.6	13.6	11.6	*14.8
26	14.4	13.2	19.6	12.4	15.0	*15.2
27	15.2	13.2	17.6	12.0	13.0	*15.2
28	13.0	14.0	10.2	11.0	13.6	15.6
29	13.4	12.0	17.0	*12.6	11.8	14.4
30	13.0	14.6	16.0	*12.4	11.8	13.0
31	15.0	15.0	14.8	*11.8	13.0	15.0
32	12.8	15.8	16.8	*12.0	13.8	15.2
33	14.4	13.4	17.2	*14.0	14.0	15.0
34	15.8	14.0	18.2	12.4	13.4	14.2
35	15.0	12.2	17.2	13.4	13.6	12.2
36	*14.4	*14.2	16.6	11.4	15.0	11.4
37	*15.2	*14.8	15.0	12.0	13.8	13.2
38	*17.2	13.0	17.2	11.8	12.2	14.8
39	*13.8	14.0	*15.8	13.2	13.4	16.2
40	*13.4	12.0	*15.2	11.0	11.6	15.0
41	12.8	14.0	*18.0	12.6	13.4	12.8
42	13.4	12.8	*17.8	14.0	12.0	13.6
43	11.8	14.2	15.2	15.6	13.2	12.4
44	13.4	15.0	16.0	12.0	13.6	*abs.
45	13.6	12.4	15.0	13.6	11.4	*12.0

TABLE 5
Daily Record of the Soccer Dribble Test
(Continued)

Date	January 6, 1926, to March 9, 1926							
Day	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8
1	19.0	22.0	29.0	30.0	14.2	21.2	19.0	19.2
2	17.2	23.0	25.0	29.2	15.6	20.0	*23.0	19.0
3	17.4	16.0	27.8	28.2	16.2	21.0	*15.2	17.8
4	13.8	19.4	18.8	30.0	15.2	18.0	*21.2	19.2
5	14.4	*22.6	21.0	23.0	14.4	22.4	*15.8	18.0
6	15.4	*16.0	17.8	21.0	14.0	18.0	16.0	15.0
7	13.4	*17.0	25.0	20.0	*13.6	*19.0	16.0	17.4
8	14.4	*18.4	18.6	16.4	*14.2	*18.0	16.6	15.0
9	14.8	14.0	19.0	15.4	*12.4	*21.0	15.4	*17.6
10	13.4	12.4	17.0	15.4	*13.0	*17.0	17.2	*15.0
11	16.2	13.4	17.4	*13.6	13.4	18.0	14.4	*17.4
12	16.0	16.0	22.6	*14.8	12.8	15.8	14.4	14.2
13	13.0	15.0	17.8	*13.2	14.8	21.4	12.4	17.6
14	13.0	14.2	*18.2	*12.4	20.4	19.0	15.0	16.2
15	15.0	15.0	*18.0	*14.0	14.2	16.8	13.6	14.2
16	18.0	13.6	*15.8	12.8	11.0	16.0	14.0	17.2
17	15.2	12.6	*15.0	11.0	11.8	17.2	14.6	15.0
18	13.6	15.0	abs.	12.2	11.6	15.0	16.4	14.2
19	14.0	13.0	abs.	16.8	12.2	15.0	12.4	abs.
20	abs.	16.0	abs.	15.0	14.6	15.0	15.8	abs.
21	abs.	16.4	abs.	12.4	12.8	15.8	16.2	abs.
22	abs.	14.0	abs.	16.2	12.0	15.6	*12.0	abs.
23	abs.	13.8	15.0	12.6	11.4	18.0	*16.0	abs.
24	15.4	13.0	19.0	14.6	10.0	15.0	*16.4	16.8
25	14.2	15.0	20.0	12.2	11.0	15.0	15.0	14.2
26	13.6	12.0	16.8	17.2	11.6	17.8	14.8	14.6
27	14.2	15.4	17.2	15.0	11.8	*19.4	13.4	*15.4
28	12.8	14.8	19.4	15.0	11.8	*14.0	13.4	*14.4
29	10.6	*14.0	16.8	13.2	11.0	*13.2	13.4	*16.2
30	11.0	*17.4	20.0	15.0	10.6	13.6	16.6	15.0
31	12.4	15.0	14.0	13.4	11.2	13.4	11.0	17.4
32	11.0	11.6	16.4	14.4	11.2	15.0	11.6	13.8
33	11.4	13.0	15.0	13.0	11.6	13.2	11.4	14.8
34	14.8	14.8	*16.6	16.8	9.6	15.4	11.6	15.0
35	12.0	12.2	*18.4	abs.	13.8	13.4	10.6	14.4
36	14.0	14.4	*16.4	*14.0	11.6	15.0	12.0	11.6
37	12.2	15.4	*17.0	*13.2	10.6	13.6	10.8	15.2
38	*12.0	15.0	17.4	*15.0	11.0	15.6	11.4	12.2
39	*14.0	13.0	17.0	*13.0	9.2	13.0	11.8	15.0
40	*11.4	13.0	17.2	*12.2	11.2	12.0	*11.0	15.2
41	11.8	14.0	16.8	14.8	10.8	14.2	*11.6	14.0
42	12.4	14.0	16.0	12.0	10.2	13.2	*11.0	13.8
43	12.0	14.0	14.0	13.0	11.0	15.0	*11.2	16.2
44	13.0	14.0	14.0	12.4	11.0	11.8	11.4	11.2
45	10.8	12.8	17.0	11.8	10.4	13.0	11.2	12.4

TABLE 5
Daily Record of the Soccer Dribble Test
(Continued)

Date	October 19, 1925, to December 18, 1925	January 6, 1926, to March 9, 1926		
Day	M5	M1	M2	M4
1	26.0	19.2	12.8	11.0
2	24.0	17.0	12.8	9.8
3	28.4	14.4	13.8	10.0
4	16.2	14.2	15.6	9.4
5	15.8	12.0	12.6	9.8
6	18.0	15.0	14.0	10.2
7	14.4	10.0	13.0	7.8
8	14.0	10.8	12.2	8.2
9	14.0	11.0	12.2	8.2
10	12.4	17.0	11.8	7.6
11	15.8	11.0	11.4	9.8
12	13.4	9.0	12.4	7.2
13	12.6	10.6	10.8	8.0
14	14.6	11.4	11.6	8.2
15	13.2	12.8	9.6	8.0
16	13.0	12.0	10.0	9.0
17	13.2	9.4	11.2	9.2
18	15.2	9.4	11.0	10.0
19	14.8	10.2	10.2	8.6
20	13.2	9.8	11.0	8.8
21	13.4	8.8	10.6	9.0
22	15.8	8.8	11.4	9.2
23	15.0	9.4	12.0	9.2
24	15.0	10.6	10.6	9.2
25	12.2	9.8	10.0	7.8
26	14.0	8.6	11.2	7.2
27	14.2	9.2	10.0	7.4
28	12.2	9.4	10.0	7.8
29	12.4	12.0	10.2	9.0
30	15.4	11.2	11.0	7.0
31	11.8	10.6	10.0	10.0
32	13.2	9.6	12.2	7.4
33	13.8	12.4	10.4	7.4
34	12.4	11.2	11.2	11.2
35	12.8	13.2	11.6	7.8
36	12.4	10.0	11.2	8.0
37	12.4	10.6	11.4	6.8
38	12.6	9.4	10.0	6.8
39	12.2	11.2	9.2	7.2
40	12.8	9.8	9.6	9.0
41	13.0	8.6	9.4	6.8
42	14.8	11.0	9.2	9.2
43	14.0	11.0	12.0	sprained
44	13.4	11.2	9.6	ankle
45	12.8	9.8	9.6	"

TABLE 6
The Soccer Dribble Test

A record of each individual variation from the average, reduced to a multiple of the mean variation of the group, figured in six day periods before and after, and four day periods during menstruation.

+ == worse than the average
- == better than the average

First Period					Second Period					
N3			N5		N6		Algebraic sum		Average	
-1.40	.....	.....	.....	.....	-0.13	-1.53	-0.76	-1.72	-0.20	+1.55
-0.50	.....	.....	.....	.....	+1.60	+0.55	+1.10	+1.00	-1.00	+1.57
+0.17	.....	.....	.....	.....	+2.54	+3.71	+1.85	-1.42	+0.14	+1.56
+0.09	.....	.....	.....	.....	+1.40	+1.49	+0.74	-1.55	0.00	+1.55
-1.54	.....	.....	.....	.....	+1.50	-0.04	-0.02	-0.04	-0.10	+0.15
+0.50	.....	.....	.....	.....	+1.35	+1.85	+0.92	-0.43	-1.06	-0.66
*-0.54	*+0.84	*+1.52	*+1.82	*+0.60	*+0.60	*-1.55	*-0.83	*-0.05	*-0.09	*+1.46
*	*+0.87	*+0.08	*+0.95	*+0.47	*+0.47	*-0.83	*-0.05	*	*+0.69	*+1.57
*	*+1.30	*+2.08	*+3.38	*+1.69	*+1.69	*+1.53	*	*	*+3.08	*+1.55
*-1.54	*+1.04	*+1.54	*+1.04	*+0.34	*+0.34	*-0.80	*	*	*+0.92	*+1.72
-1.00	+1.17	+1.52	+1.69	+0.53	+0.53	-1.05	-1.40	+1.15	-1.30	+1.15
-1.28	+2.00	+1.47	+2.19	+0.73	+0.73	-0.76	-0.66	+0.13	-1.29	+0.13
-0.61	-1.33	+1.50	-0.44	-0.14	-0.14	-1.46	-1.21	+1.44	-1.23	+1.44
-0.40	-0.61	+1.60	-0.59	-0.17	-0.17	-0.15	-0.43	.....	-0.60	.....
-1.00	-1.50	+1.50	0.00	0.00	0.00	-0.11	-0.52	.....	-0.63	.....
-0.66	-1.42	+1.53	-0.55	-0.18	-0.18	.....	+0.38	.....	+0.38	.....

TABLE 6
The Soccer Dribble Test
First Period

+ = worse than the average
- = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
.....	.....	+1.28	+1.50	-1.87	-0.12	-0.30	-0.47	+0.02	+0.003
.....	.....	+1.25	+2.68	-1.59	-0.46	+0.31	-0.66	+1.53	+0.25
.....	+0.07	+1.25	+0.76	-0.88	+0.36	+1.76	+0.26	+3.58	+0.51
.....	+0.31	+1.05	-0.15	-1.40	-0.46	-1.07	-1.00	+2.72	+0.38
.....	-0.94	+1.45	-0.36	-1.32	+1.02	+1.20	0.00	+1.05	+0.15
.....	0.00	+0.89	+0.25	-1.62	+0.75	+1.36	-1.07	+0.56	+0.08
*	+1.08	*+0.91	*-1.05	*-1.15	*+0.48	*-1.35	*+0.63	*-0.45	*+0.06
*	*-0.37	*+2.58	*-0.18	*-1.69	*+1.23	*+0.76	* 0.00	*+2.33	*+0.33
*	*-0.17	*+0.60	*-1.00	*-1.72	*+2.22	*+0.66	*-1.05	*+1.64	*+0.23
*	*+0.76	*+0.84	*-1.50	*-1.25	*+1.25	.....	*	*+1.10	*+0.22
.....	.....	+0.69	-0.90	-1.16	+1.38	-0.23	-0.32	-1.54	-0.22
.....	-1.62	.....	-1.57	-0.58	-0.01	0.00	+0.83	-2.95	-0.49
.....	-1.16	.....	-1.46	-0.33	+2.42	-1.05	+0.08	-1.50	-0.25
.....	+0.01	.....	+2.07	+1.83	+1.25	-0.71	-0.58	+3.87	+0.77
.....	-0.25	.....	-0.40	-0.75	+1.41	-0.06	+1.46	-1.41	-0.23
.....	-0.91	.....	-1.35	-1.80	+0.70	+0.78	+0.52	-2.06	-0.34

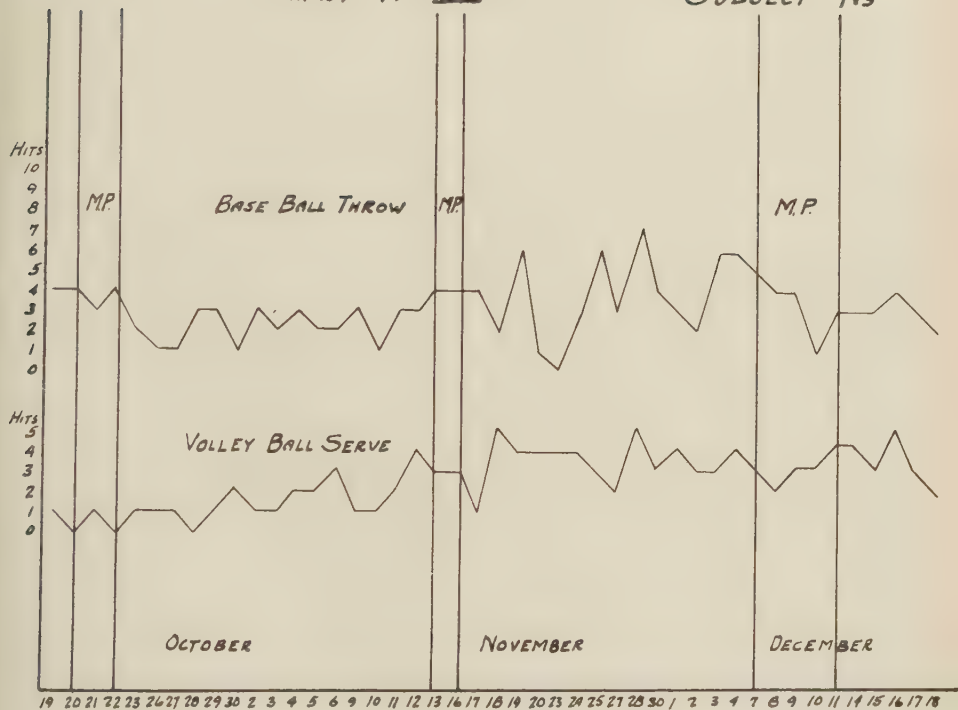
TABLE 6
The Soccer Dribble Test
Second Period

+ = worse than the average
- = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
-1.20	-0.28	+3.57	+0.04	.....	+0.64	-1.42	.....	+1.35	+0.22
-1.37	-0.95	+2.06	-0.20	.....	+1.00	-1.57	.....	-1.03	-0.17
+0.26	+0.23	+2.12	+1.06	.....	+1.71	-1.14	.....	+4.24	+0.70
-0.08	-1.55	+1.30	+0.99	.....	0.00	-1.00	.....	-0.34	-0.05
+0.28	+0.11	+0.80	+1.31	.....	+0.23	-1.10	+0.85	+2.48	+0.35
-0.72	+0.28	+1.90	.....	.....	+1.66	-1.08	-0.23	+1.81	+0.30
*-0.85	*	*+1.21	*+0.28	*	*+3.05	*-1.11	*-0.11	*+2.47	*+0.41
*+2.52	*	*+2.52	*-0.11	*	*-0.28	*-1.18	*+0.11	*+1.06	*+0.21
*-0.82	*+1.04	*+2.00	*+0.65	*	*-0.18	*+1.28	* 0.00	*+4.02	*+0.57
.....	.....	*+1.94	*-0.08	.....	*	*-1.40	*+1.68	*+0.57	*+0.39
-0.28	+0.80	+1.65	-0.57	.....	-0.54	-0.90	+0.09	+1.36	+0.19
-1.05	+1.10	+1.85	+0.81	.....	-0.26	-0.75	+1.80	+2.45	+0.35
-0.86	+0.99	+2.64	-0.20	.....	+1.46	.....	+0.66	+4.69	+0.78
+0.70	+0.26	+2.06	-0.10	.....	+0.27	.....	+1.72	+4.91	+0.81
-1.00	-0.73	+2.28	+0.37	.....	+0.58	.....	+0.36	+1.86	+0.31
.....	+0.52	+0.46	.....	.....	-0.15	.....	+0.52	+1.35	+0.33

CHART N^o XII

SUBJECT N₃



DAILY RECORD FOR 90 DAYS

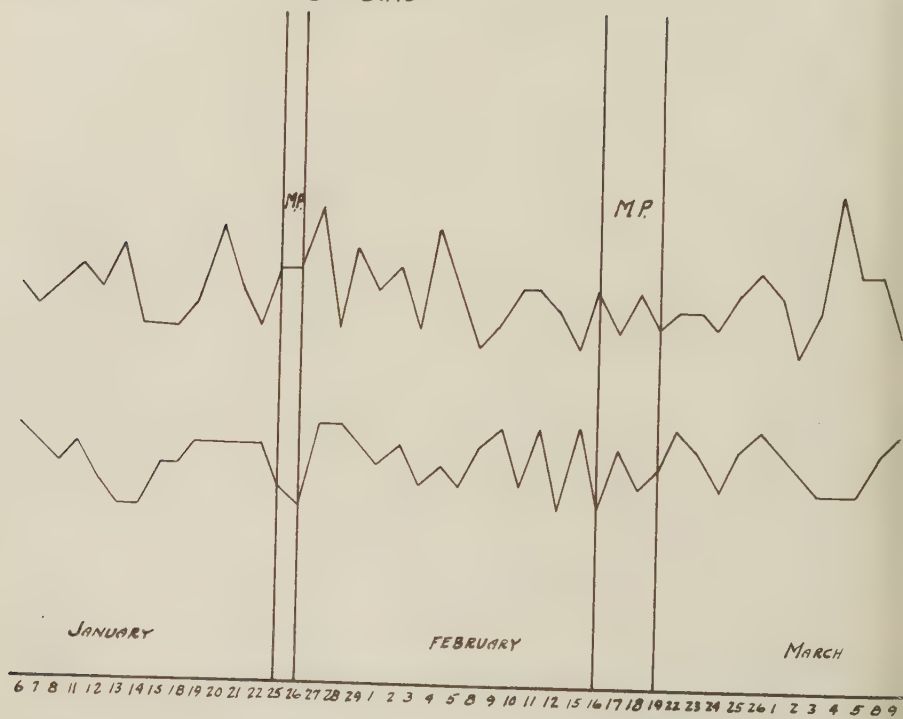
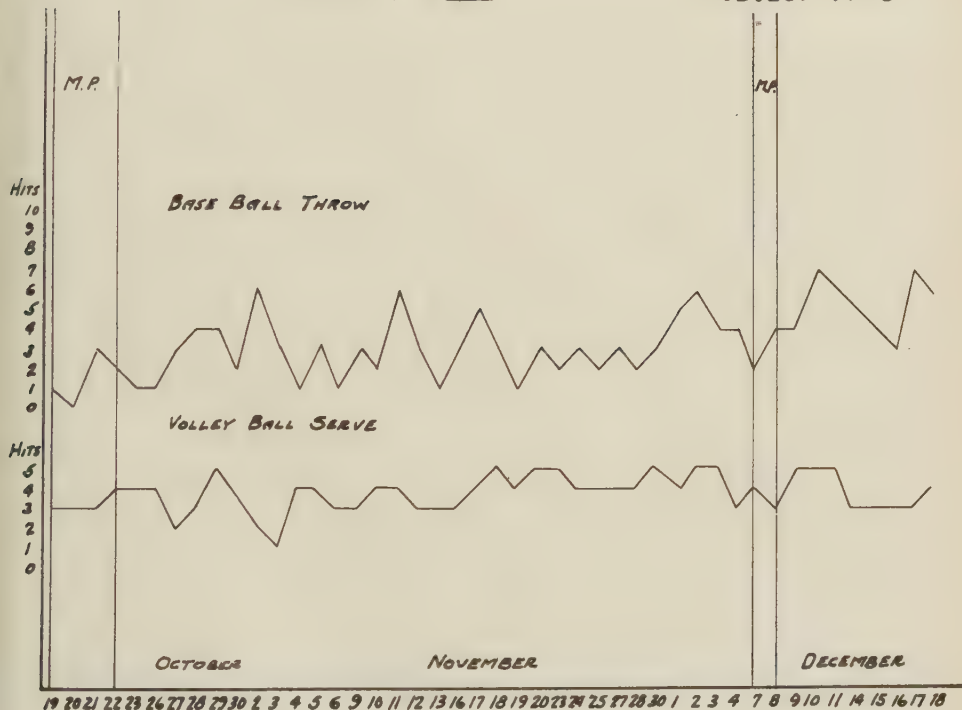


CHART N^o XIII

SUBJECT N^o 5



DAILY RECORD FOR 90 DAYS

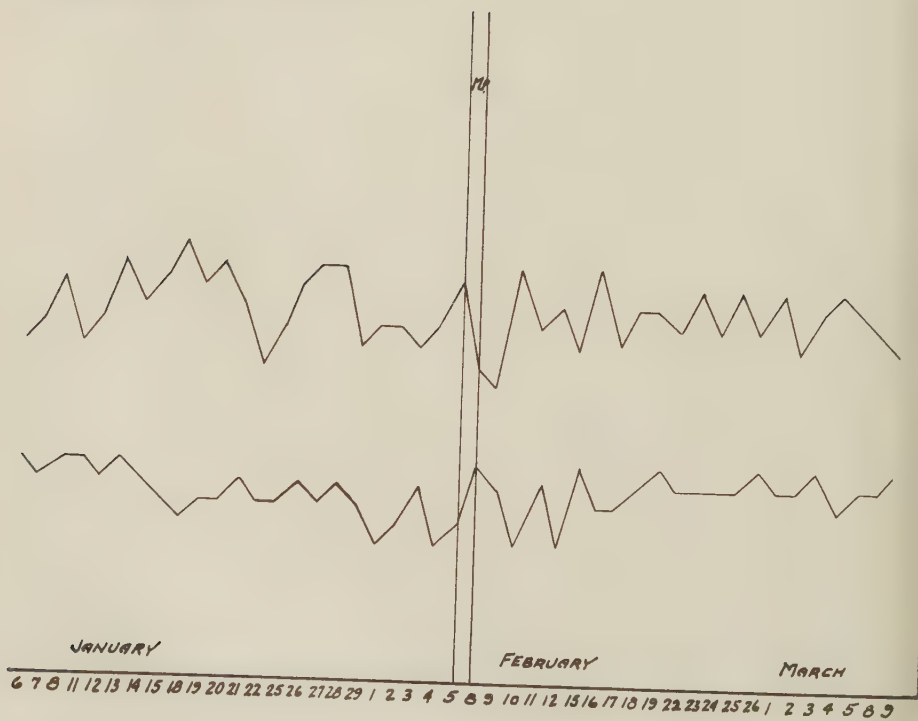
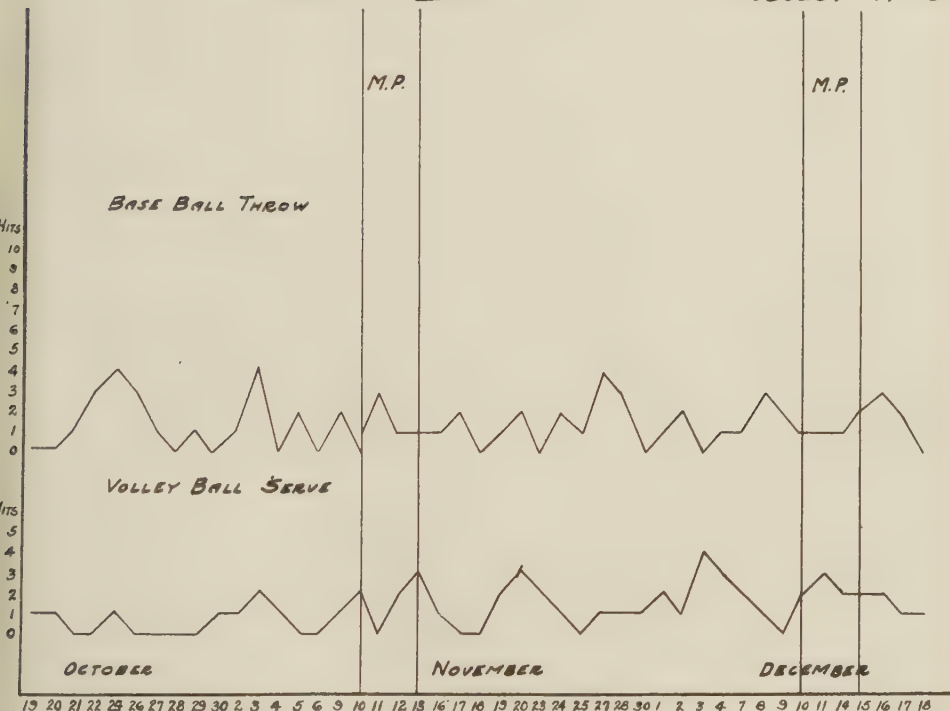
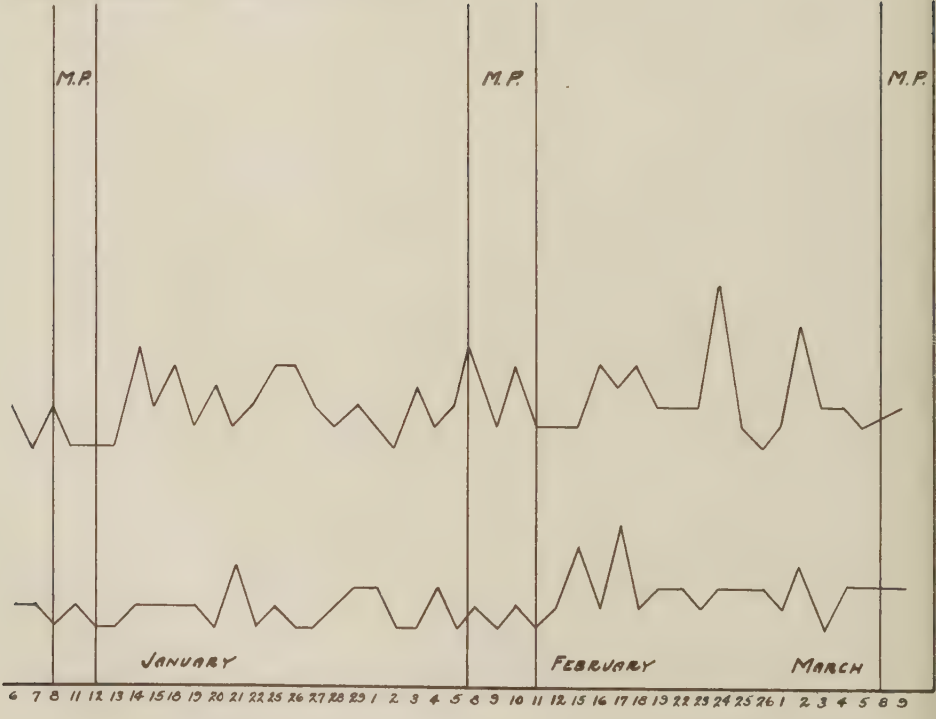


CHART N° XIV

SUBJECT N° 6



DAILY RECORD FOR 90 DAYS



CHAPTER V

MOTOR TESTS OF ACCURACY AND CO-ORDINATION

This study included two tests which measured accuracy of motion and body co-ordination, namely, the baseball target throw and the volleyball serve. Both of these tests have been widely used in schools and have proven to be simple and concrete and easily measurable.

Table 7 gives the daily records of the subjects under examination with the dates of performance for the baseball target throw. Five of the critical periods of the N group on this table show an increase of efficiency on the first day of the onset, while four critical periods show a slight decrease of accuracy in throwing. In the AB group, there is an increase of efficiency on ten occasions and a decrease of accuracy on four. It appears, therefore, that menstruation, in the cases studied here, has no effect on muscular co-ordination and that skill is not decreased at those periods. Indeed, it appears that, if conclusions may be drawn from the limited number of subjects studied, menstruation **may** be a period of increased efficiency of movement. It is obviously not a period of impaired motor efficiency as is supposed by the average person, even in the abnormal group which records discomfort and pain during menstrual periods.

Charts 12, 13, and 14 give the 90 day curves for the N group in both the volleyball serve and baseball target throw. It is apparent that daily fluctuations are numerous in both tests, and that they are also evident in the men's records as well. The practice element does not appear as prominently as in the speed events, and the final records of the majority of subjects is not very much better than their beginning scores. The same tendency towards a rhythm every two to four days is evident, and whether the menstrual period occurs simultaneously with a peak or depression of this rhythm appears to be largely a matter of chance.

Table 8 gives the multiples of the mean variation of the baseball records, taken in the six day and four day periods. Eight of the normal days of the N group recorded a score the same as or poorer than the average of the critical periods, while in the AB group 13 out of 24 normal days were the same as or poorer than the critical period average. This demonstrates again the negligible influence of menstruation on motor skill—the AB group which was physically influenced by the physiological function in question recording a higher period of efficiency during the critical periods.

Table 9 gives the daily records of the volleyball serve. In the N group, the first critical days on six occasions were more efficient than normal days immediately preceding the period; on

four occasions they were worse. In the AB group 9 of the critical first days were better than normal days preceding; four were worse.

Charts 15 and 16 give the AB curves for the baseball throw and volleyball serve. They are self-explanatory. Fluctuations are frequent and without apparent reason, at least as far as questionnaire replies could ascertain.

Table 10 gives the mean variation of this same test. In the N group 12 of the 24 normal days record scores the same as or poorer than the average of the critical periods. In the AB group the same result is obtained.

Chart 17 gives a picture of the composite men's record for the volleyball and baseball tests. This chart shows the usual high and low points of efficiency, all more or less accidental in nature.

From this study of tests of accuracy of motion, it may be concluded that menstruation has no effect, adverse or favorable, on the skill of motion.

CHART XV BASE BALL THROW AB GROUP

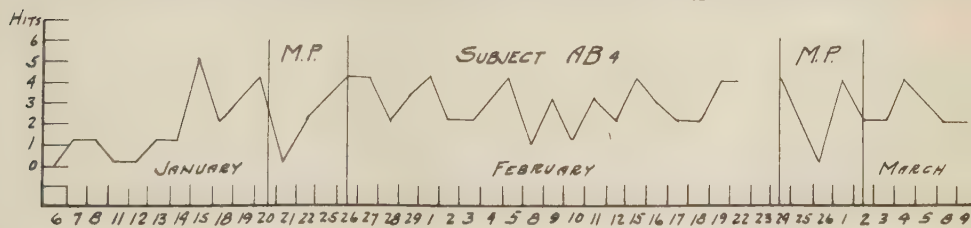
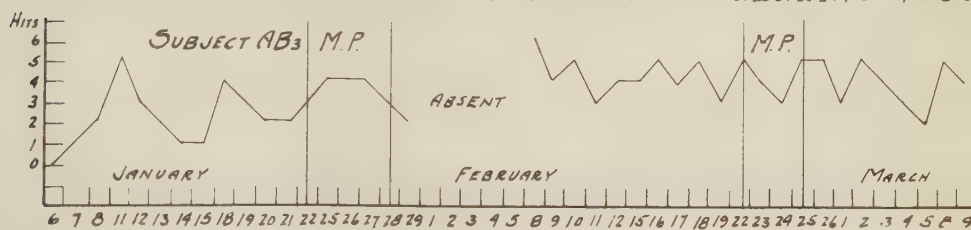
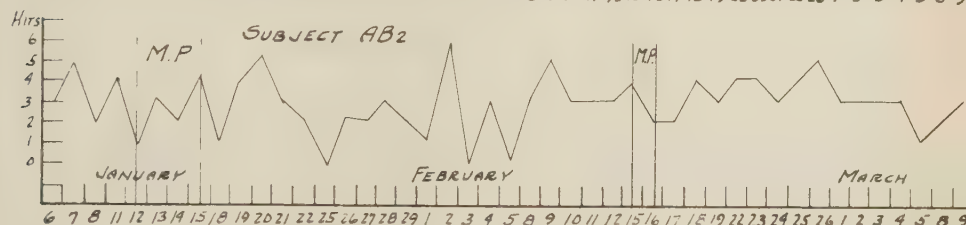
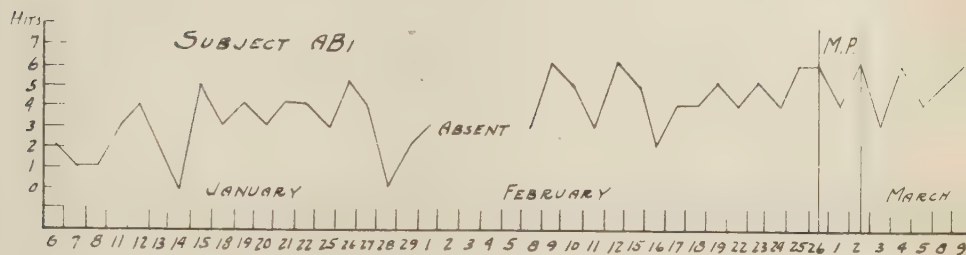


CHART XV BASE BALL THROW AB GROUP

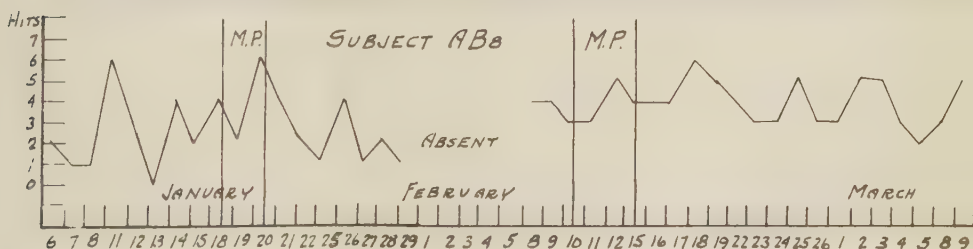
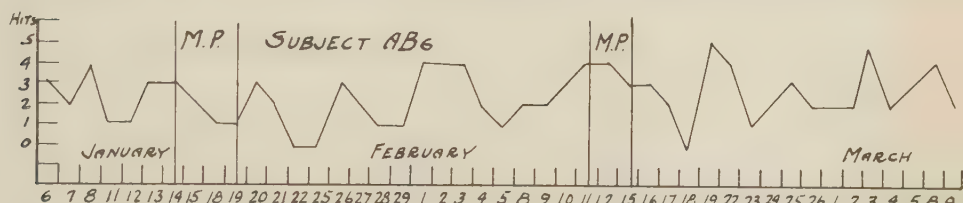
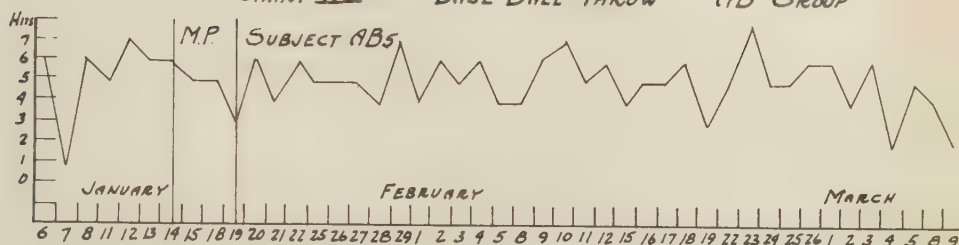


CHART XVI VOLLEY BALL SERVE AB GROUP

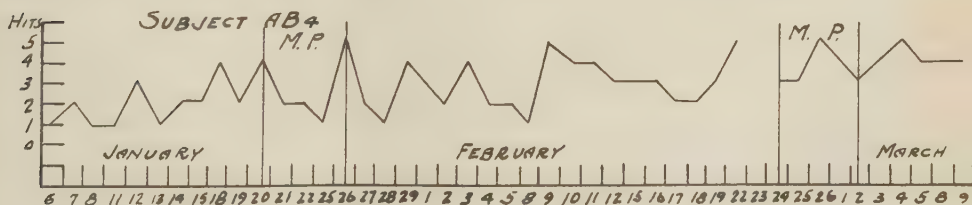
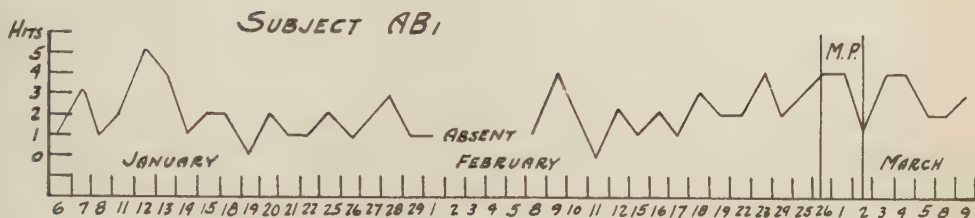


CHART XVI

VOLLEY BALL SERVE

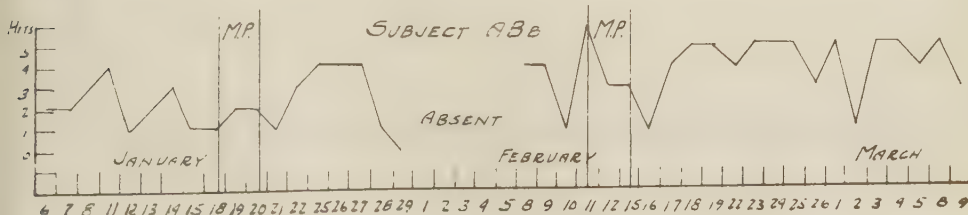
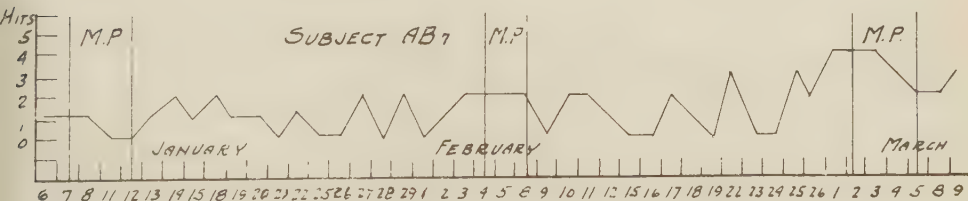
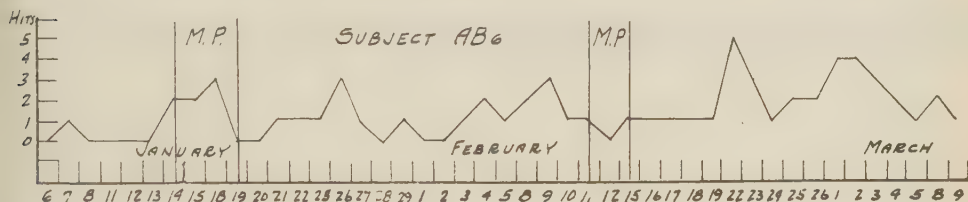
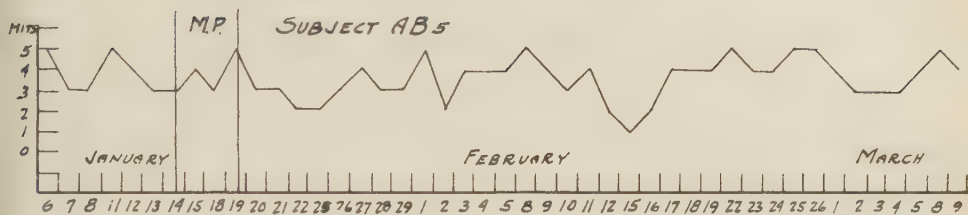


CHART XVII COMPOSITE CURVE VOLLEY BALL SERVE - MEN

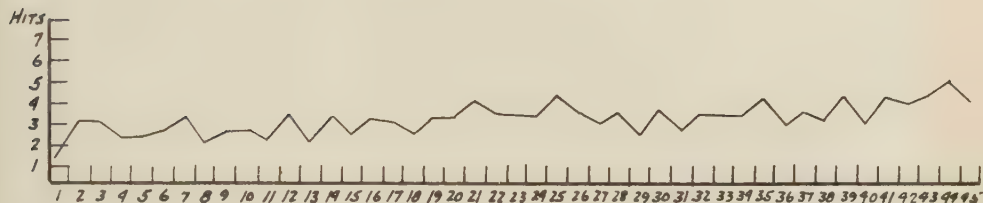


CHART COMPOSITE CURVE BASE BALL THROW - MEN



TABLE 7

Daily Record of the Baseball Target Throw

The number of hits made out of a possible 10. Menstrual periods indicated by a star (*).

Date Day	October 19, 1925, to December 18, 1925			January 6, 1926, to March 9, 1926		
	N3	N5	N6	N3	N5	N6
1	4	*1	0	4	3	2
2	*4	*0	0	3	4	0
3	*3	*3	1	4	6	*2
4	*4	*2	3	5	3	*0
5	2	1	4	4	4	*0
6	1	1	3	6	7	0
7	1	3	1	2	4	5
8	3	4	0	2	5	2
9	3	4	1	2	8	4
10	1	2	0	3	6	1
11	3	6	1	7	7	3
12	2	3	4	4	5	1
13	3	1	0	2	2	2
14	2	3	2	*5	4	4
15	2	1	0	*5	6	4
16	3	3	2	8	7	2
17	1	2	*0	2	7	1
18	3	6	*3	6	3	2
19	3	3	*1	4	4	1
20	4	1	*1	5	4	0
21	4	3	1	2	3	3
22	4	5	2	7	4	1
23	2	3	0	4	*6	2
24	6	1	1	1	*2	*5
25	2	3	2	2	1	*1
26	1	2	0	4	7	*4
27	3	3	2	4	4	*1
28	6	2	1	3	5	*1
29	3	3	4	*1	3	1
30	7	2	3	*4	7	4
31	4	3	0	*2	3	3
32	3	5	1	*4	5	4
33	2	6	2	*2	5	2
34	6	4	0	3	4	2
35	6	*4	1	3	6	2
36	5	*2	1	2	4	8
37	4	4	3	4	6	1
38	4	4	2	5	4	0
39	1	7	*1	4	6	1
40	3	6	*1	1	3	6
41	3	5	*1	3	5	2
42	3	4	*2	9	6	2
43	4	3	3	5	5	1
44	3	7	2	5	4	*abs.
45	2	6	0	2	3	*2

TABLE 7
Daily Record of the Baseball Target Throw

Date	January 6, 1926, to March 9, 1926							
Day	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8
1	2	3	0	0	6	3	1	2
2	1	5	1	1	1	2	*0	1
3	1	2	2	1	6	4	*1	1
4	3	4	5	0	5	1	*2	6
5	4	*1	3	0	7	1	*1	3
6	2	*3	2	1	6	3	4	0
7	0	*2	1	1	*6	*3	2	4
8	5	*4	1	5	*5	*2	5	2
9	3	1	4	2	*5	*1	5	4
10	4	4	3	3	*3	*1	3	2
11	3	5	2	*4	6	3	1	6
12	4	3	2	*0	4	2	2	4
13	4	2	3	*2	6	0	2	2
14	3	0	*4	*3	5	0	3	1
15	5	2	*4	*4	5	3	3	4
16	4	2	*4	4	5	2	3	1
17	0	3	*3	2	4	1	3	2
18	2	2	2	3	7	1	1	1
19	3	1	abs.	4	4	4	1	abs.
20	abs.	6	abs.	2	6	4	3	abs.
21	abs.	0	abs.	2	5	4	3	abs.
22	abs.	3	abs.	3	6	2	*3	abs.
23	abs.	0	abs.	4	4	1	*4	abs.
24	3	3	6	1	4	2	*4	4
25	6	5	4	3	6	2	4	4
26	5	3	5	1	7	3	4	3
27	3	3	3	3	5	*4	5	*3
28	6	3	4	2	6	*4	3	*5
29	5	*4	4	4	4	*3	4	*4
30	2	*2	5	3	5	3	1	4
31	4	2	4	2	5	2	2	4
32	4	4	5	2	6	0	3	6
33	5	3	3	4	3	5	1	5
34	4	4	*5	4	5	4	3	4
35	5	4	*4	abs.	0	1	2	3
36	4	3	*3	*4	5	2	2	3
37	6	4	*5	*2	5	3	4	5
38	*6	5	5	*0	6	2	4	3
39	*4	3	3	*4	6	2	1	3
40	*6	3	5	*2	4	2	*4	5
41	3	3	4	2	6	5	*5	5
42	6	3	3	4	2	2	*4	3
43	4	1	2	3	5	3	*2	2
44	5	2	5	2	4	4	3	3
45	5	3	4	2	2	2	5	5

TABLE 7

Daily Record of the Baseball Target Throw

Date	October 19, 1925, to December 18, 1925		January 6, 1926, to March 9, 1926	
Day	M5	M1	M2	M4
1	4	3	4	3
2	3	4	6	8
3	4	5	4	6
4	3	4	6	2
5	2	6	6	7
6	2	7	5	6
7	4	5	10	9
8	6	2	3	8
9	6	5	8	8
10	4	7	5	9
11	4	8	6	6
12	4	5	8	7
13	2	4	6	6
14	7	5	5	5
15	4	5	7	4
16	10	4	4	6
17	10	2	9	5
18	6	4	8	6
19	8	4	5	8
20	5	5	5	5
21	5	2	5	4
22	7	5	6	10
23	4	4	5	7
24	2	3	4	7
25	9	2	5	8
26	6	6	4	8
27	4	5	5	7
28	6	5	3	6
29	5	4	5	8
30	7	4	4	4
31	4	5	2	8
32	8	3	5	7
33	7	3	4	9
34	3	2	6	6
35	4	4	3	8
36	5	4	3	7
37	8	3	2	7
38	3	7	5	8
39	8	4	6	8
40	5	5	5	6
41	5	4	6	5
42	3	2	6	8
43	6	5	5	abs.
44	5	3	4	5
45	5	3	5	5

TABLE 8
The Baseball Target Throw
First Period

— = worse than the average
+ = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
.....	-2.14	.....	-1.17	+2.84	+0.71	0.00	-1.00	-0.76	-0.12
.....	+0.71	.....	-1.05	0.00	+1.42	+1.00	+1.87	+3.95	+0.65
.....	0.00	+0.71	-0.90	+2.00	+2.00	-0.90	+0.58	+3.49	+0.49
.....	-1.33	-5.71	+0.71	+1.25	-1.25	-1.66	-1.57	-10.56	-1.50
.....	-0.90	0.00	-0.71	+2.94	-0.58	-0.83	+1.09	+1.01	+0.14
.....	0.00	+0.62	0.00	+1.57	+1.05	+1.11	-1.42	+5.77	+0.82
*	+1.25	*-0.58	* 0.00	*+3.63	*+0.90	* 0.00	*+0.71	*+5.91	*+0.84
*	* 0.00	* 0.00	*-2.72	*+0.71	*-1.42	*+0.62	*-1.56	*-4.47	*-0.63
*	*+0.90	* 0.00	*-1.00	*+1.42	*-1.42	*-0.58	*-1.33	*-0.85	*-0.12
*	*+1.00	* 0.00	*+0.62	* 0.00	*-3.33	* 0.00	*	*-1.71	*-0.28
.....	-1.42	0.00	+0.90	+1.33	-0.90	0.00	+0.90	+0.81	+0.13
.....	+1.66	.....	0.00	+0.90	-3.00	+1.11	-1.00	-0.33	-0.05
.....	+0.60	.....	+0.90	+3.00	-1.25	-0.90	-0.62	+1.79	+0.29
.....	0.00	.....	+0.83	+1.87	-1.42	0.00	0.00	+1.28	+0.21
.....	-1.00	.....	-1.66	+1.42	-0.90	-1.66	-1.81	-5.61	-0.93
.....	-1.25	.....	-0.55	+1.81	-1.00	-1.66	0.00	-2.65	-0.44

*

TABLE 8
The Baseball Target Throw
Second Period

— = worse than the average
+ = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
+0.00	0.00	0.00	0.00	.....	+0.55	-2.50	.....	-1.95	-0.32
+0.90	0.00	+1.00	-1.66	.....	-1.66	-1.25	.....	-2.67	-0.44
0.00	+1.66	-0.71	-1.33	.....	-1.25	-0.83	.....	-2.46	-0.41
+0.62	0.00	-1.11	0.00	.....	-0.58	0.00	.....	-1.07	-0.17
+0.83	+0.66	-0.90	0.00	.....	-2.00	0.00	+0.58	-0.83	-0.11
+2.00	-0.90	0.00	.....	.....	-0.71	-1.42	0.00	-1.03	-0.17
*+1.25	*+2.50	*	*+0.83	*	* 0.00	* 0.00	*-0.71	*+3.87	*+0.64
*	* 0.00	*	*-2.00	*	* 0.00	*+0.90	*-1.11	*-2.21	*-0.44
*+0.71	* 0.00	*-0.83	*-2.50	*	*-0.50	*+1.13	*+0.90	*-1.09	*-0.15
+1.09	*+1.00	*-1.66	*+0.71	*	*	*-1.00	* 0.00	*+0.14	*+0.02
-0.90	+0.62	0.00	-1.09	.....	0.00	0.00	+0.83	-0.54	-0.07
+3.33	0.00	-0.90	+1.11	.....	-1.66	+1.66	0.00	+3.54	+0.50
+1.00	+0.90	0.00	0.00	.....	-2.66	.....	+1.33	+0.57	+0.09
+2.00	0.00	0.00	-1.00	.....	+0.90	.....	+0.90	+2.80	+0.46
+1.66	0.00	0.00	-0.83	.....	0.00	.....	0.00	+0.83	+0.13
.....	-1.00	0.00	.....	.....	-1.87	.....	-0.62	-3.49	-0.87

TABLE 9

Daily Record of the Volley Ball Serve

The number of successful serves made out of a possible five. Menstrual periods indicated by a star (*).

Date	October 19, 1925, to December 18, 1925			January 6, 1926, to March 9, 1926,		
	N3	N5	N6	N3	N5	N6
1	1	*3	1	5	5	1
2	*0	*3	1	4	4	1
3	*1	*3	0	3	5	*0
4	*0	*4	0	4	5	*1
5	1	4	1	2	4	*0
6	1	4	0	1	5	0
7	1	2	0	1	4	1
8	0	3	0	3	3	1
9	1	5	0	3	2	1
10	2	4	1	4	3	1
11	1	2	1	4	3	0
12	1	1	2	4	4	3
13	2	4	1	4	3	0
14	2	4	0	*2	3	1
15	3	3	0	*1	4	0
16	1	3	1	5	3	0
17	1	4	*2	5	4	1
18	2	4	*0	4	3	2
19	4	3	*2	3	1	2
20	*3	3	*3	4	2	0
21	*3	3	1	2	4	0
22	1	4	0	3	1	2
23	5	5	0	2	*2	0
24	4	4	2	4	*5	*1
25	4	5	3	5	4	*0
26	4	5	2	2	1	*1
27	4	4	1	5	4	*0
28	3	4	0	1	1	1
29	2	4	1	*5	5	4
30	5	4	1	*1	4	1
31	3	5	1	*4	3	5
32	4	4	2	*2	4	1
33	3	5	1	*3	5	2
34	3	5	4	5	4	2
35	4	3	3	4	4	1
36	3	*4	2	2	4	2
37	2	*3	1	4	4	2
38	3	5	0	5	5	2
39	3	5	*2	4	4	1
40	4	5	*3	3	4	3
41	4	3	*2	2	5	0
42	3	3	*2	2	3	2
43	5	3	2	2	4	2
44	3	3	1	4	4	*abs.
45	2	4	1	5	5	*2

TABLE 9
Daily Record of the Volley Ball Serve

Date	January 6, 1926, to March 9, 1926							
Day	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8
1	1	0	0	1	5	0	1	2
2	3	2	0	2	3	1	*1	2
3	1	2	0	1	3	0	*1	3
4	2	2	0	1	5	0	*0	4
5	5	*2	0	3	4	0	*0	1
6	4	*0	0	1	3	0	1	2
7	1	*0	0	2	*3	*2	2	3
8	2	*2	0	2	*4	*2	1	*1
9	2	0	0	4	*3	*3	2	*1
10	0	2	0	2	*5	*0	1	*2
11	2	2	0	*4	3	0	1	*2
12	1	0	1	*2	3	1	0	1
13	1	0	1	*2	2	1	1	3
14	2	4	*4	*1	2	1	0	4
15	1	3	*2	*5	3	3	0	4
16	2	3	*2	2	4	1	2	4
17	3	1	0	1	3	0	0	1
18	1	2	1	4	3	1	2	0
19	1	0	abs.	3	5	0	0	abs.
20	abs.	1	abs.	2	2	0	1	abs.
21	abs.	3	abs.	4	4	1	2	abs.
22	abs.	0	abs.	2	4	2	*2	abs.
23	abs.	0	abs.	2	4	1	*2	abs.
24	1	2	4	1	5	2	*2	4
25	4	3	1	5	4	3	0	4
26	2	1	2	4	3	1	2	1
27	0	1	3	4	4	*1	2	*5
28	2	4	1	3	2	*0	1	*3
29	1	1	2	3	1	*1	0	*3
30	2	4	2	3	2	1	0	1
31	1	*1	1	2	4	1	2	4
32	3	*4	2	2	4	1	1	5
33	2	3	2	3	4	1	0	5
34	2	2	*3	5	5	5	3	4
35	4	5	*3	abs.	4	3	0	5
36	2	4	*2	*3	4	1	0	5
37	3	4	*2	*3	5	2	3	5
38	*4	2	2	*5	5	2	2	3
39	*4	5	3	*4	4	4	4	5
40	*1	4	4	*3	3	4	*4	1
41	4	4	3	4	3	3	*4	5
42	4	2	4	5	3	2	*3	5
43	2	3	1	4	4	1	*2	4
44	2	4	2	4	5	2	2	5
45	3	4	3	4	4	1	3	3

TABLE 9

Daily Record of the Volley Ball Serve
 October 19, 1925, to January 6, 1926, to
 December 18, 1925 March 9, 1926

Date Day	M5	M1	M2	M4
1	2	0	2	3
2	3	2	2	5
3	2	4	2	4
4	1	2	1	5
5	3	0	3	3
6	3	0	3	4
7	3	1	4	5
8	1	2	2	3
9	2	1	4	4
10	4	2	3	2
11	1	3	3	1
12	2	4	3	5
13	3	1	2	2
14	2	5	3	4
15	0	2	5	3
16	2	4	2	5
17	2	3	4	3
18	3	0	3	5
19	1	3	5	4
20	4	2	4	3
21	4	3	4	5
22	4	3	4	4
23	3	5	2	4
24	2	4	3	4
25	5	3	5	4
26	4	5	2	4
27	2	2	4	4
28	2	4	4	4
29	2	0	3	5
30	4	3	3	5
31	2	4	2	3
32	3	3	3	5
33	5	2	4	3
34	1	5	5	3
35	3	5	5	4
36	2	5	1	4
37	1	3	5	5
38	1	3	5	4
39	3	5	4	5
40	3	1	4	4
41	3	4	5	5
42	5	2	4	5
43	3	5	5	abs.
44	5	5	5	5
45	4	4	1	4

TABLE 10
The Volley Ball Serve

A record of each individual variation from the average, reduced to a multiple of the mean variation of the group, figured in six day periods before and after, and four day periods during menstruation.

— = worse than the average
+ = better than the average

First Period					Second Period				
N3	N5	N6	Algebraic sum	Average	N3	N5	N6	Algebraic sum	Average
0.00	.....	-1.18	-1.18	-0.59	+1.06	+1.75	+0.44	+3.25	+1.08
+0.76	.....	-1.54	-0.78	-0.39	0.00	-0.75	+1.54	+0.79	+0.26
-0.66	.....	-1.54	-2.20	-1.10	+0.66	+1.54	+0.66	+2.56	+0.95
-1.18	.....	-1.54	-2.72	-1.36	0.00	+1.54	+1.54	+3.08	+1.02
-1.53	.....	-1.54	-3.07	-1.52	-1.43	+0.76	+1.43	+0.76	+0.25
+1.43	.....	-0.66	+0.77	+0.38	+1.75	+1.55	-0.75	+2.65	+0.88
* 0.00	* -2.00	* +0.27	* +1.73	* +0.57	* 0.00	* -1.18	* +1.43	* +0.25	* +0.08
*	* +1.54	* -0.76	* +0.78	* +0.39	* 0.00	* -1.43	* +1.43	* 0.00	* 0.00
*	* +1.54	* -1.43	* +0.11	* +0.05	* +0.22	* -1.43	*	* -1.21	* -0.60
* +0.77	* +1.58	* 0.00	* +2.35	* +0.78	* -0.27	* -1.74	*	* -2.01	* -1.00
-0.44	-1.44	+1.54	-0.34	-0.11	+1.43	-1.18	+1.45	+1.70	+0.56
+0.75	-1.06	+1.44	+1.13	+0.37	+0.74	-1.44	+1.54	+0.84	+0.28
+0.77	-1.45	+1.43	+0.75	+0.25	+1.54	-1.18	+1.43	+1.79	+0.59
0.00	-1.44	+1.54	+0.10	+0.03	+0.66	.....	0.00	+0.66	+0.33
+0.36	-1.43	+1.50	+0.43	+0.14	-0.27	.....	+0.75	+0.43	+0.21
+0.76	-1.54	+1.54	+0.76	+0.25	.....	.....	-0.27	-0.27	-0.27

TABLE 10
The Volley Ball Serve
First Period

- = worse than the average
+ = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Aver- age
.....	.....	-2.42	+0.75	+3.45	-1.09	-0.50	+1.88	+2.07	+0.34
.....	.....	-1.50	-0.17	+2.16	-1.16	-1.22	+1.32	-0.57	-0.09
.....	-1.09	-1.16	+0.40	+1.88	-1.44	+0.30	-0.50	-0.61	-0.08
.....	+0.50	-1.54	+0.42	+1.94	0.00	-0.88	+0.66	+1.10	+0.15
.....	+0.77	-0.14	+1.83	+1.37	-1.12	-0.33	+1.40	+2.78	+0.39
.....	+0.76	-0.10	+0.50	+1.50	-1.00	-0.80	-1.00	-0.14	-0.02
*	+0.12	*+1.38	*+2.09	*+1.40	*+0.40	* 0.00	*-0.66	*+4.73	*+0.67
*	-1.00	*-0.50	*+1.48	*+3.28	*+0.42	*-0.20	*-0.30	*+3.98	*+0.38
*	*-1.60	*-0.50	*+0.10	*+1.00	*+1.00	*-0.50	*+0.27	*+0.67	*+0.09
*	*-0.42	*-1.22	*-0.92	*+3.00	*-1.16	*	*	*-0.72	*-0.12
.....	-1.50	-0.70	-0.50	+1.18	-0.14	-2.50	-0.14	-4.30	-0.61
.....	+0.50	.....	-0.11	+2.71	-0.42	0.00	+2.42	+5.10	+0.83
.....	+0.27	.....	+2.30	+0.10	-0.92	-0.33	+1.38	+2.80	+0.46
.....	-1.57	.....	+0.88	-0.16	+0.33	-1.00	+1.16	-0.36	-0.06
.....	-1.55	.....	+1.33	+0.33	-1.75	-1.87	+2.00	-1.49	-0.24
.....	+1.38	.....	+1.20	+2.00	-1.22	-2.00	-0.11	+1.25	+0.20

* * * *

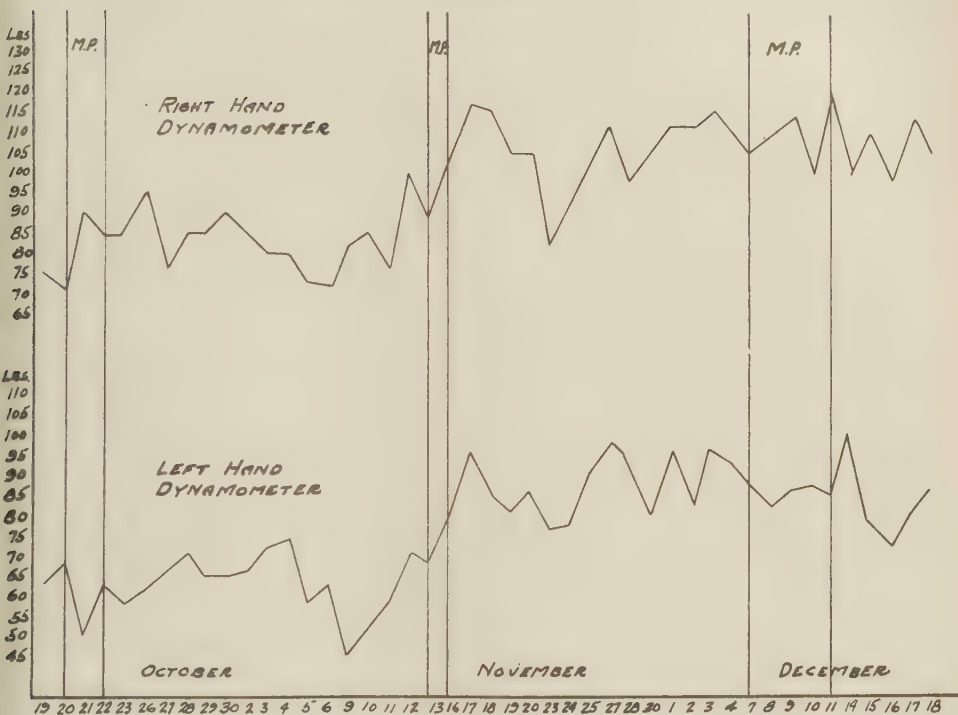
TABLE 10
The Volley Ball Serve
Second Period

— = worse than the average
+ = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
+0.25	-1.80	-1.00	+1.33	.....	-1.80	-0.54	.....	-3.36	-0.59
-0.41	-0.50	+0.62	0.00	.....	0.00	-2.83	.....	-3.12	-0.52
-1.45	0.00	+0.22	-0.58	.....	-0.80	-1.86	.....	-4.47	-0.74
+0.50	-0.14	-1.00	+0.41	.....	-0.50	-0.33	.....	-1.06	-0.17
-0.43	-1.00	-0.58	+1.27	.....	0.00	-1.00	+1.66	-0.08	-0.01
-0.33	+2.00	-0.41	.....	.....	-0.14	-1.00	+0.83	-0.95	-0.15
*+0.09	*	*-0.54	*+0.29	*	*-1.00	*+1.00	*-0.14	*-0.30	*-0.05
*.....	*.....	*-0.33	*-0.33	*	*-2.00	*+0.50	*+1.66	*-0.50	*-0.10
*-1.00	*-0.62	*-0.43	*+1.72	*	*-0.62	*-0.50	*+1.00	*-0.45	*-0.06
*-2.00	*+2.44	*-1.44	*-1.00	*	.....	*-0.54	*-1.87	*-4.41	*-0.73
+0.50	-1.00	+1.00	+0.50	.....	-0.89	-1.00	-0.89	-1.78	-0.25
+0.50	+1.08	+1.10	+1.50	.....	-1.00	-0.16	+2.00	+5.62	+0.71
+0.54	+0.41	+1.00	+1.27	.....	-1.41	.....	+1.91	+2.64	+0.44
-1.00	-1.45	+1.17	+0.66	.....	-1.25	.....	+2.08	+0.21	+0.03
-0.16	+1.33	+0.50	+1.50	.....	+1.27	.....	+0.36	+4.80	+0.80
.....	+1.00	-1.43	.....	.....	-0.33	.....	+1.33	+0.55	+0.60

CHART N^o XVIII

SUBJECT N^o 3



DAILY RECORD FOR 90 DAYS

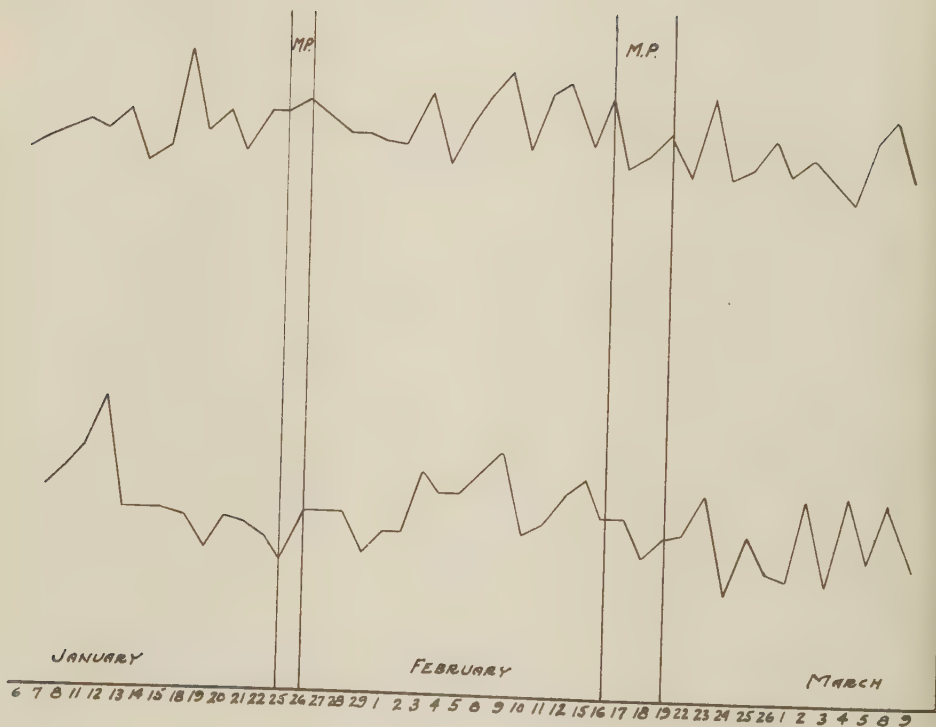
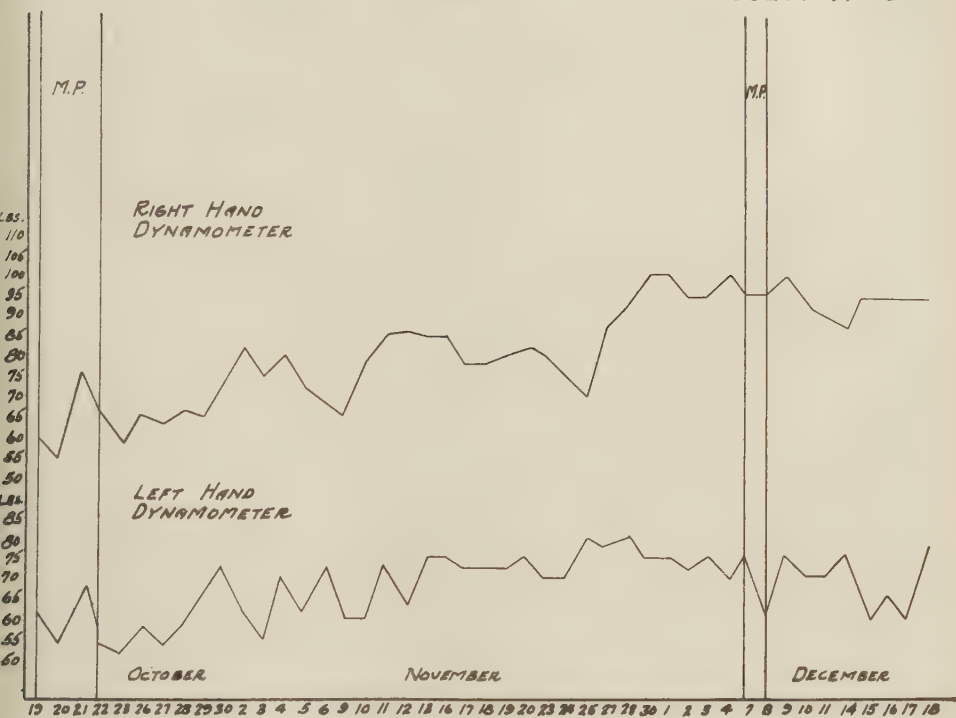


CHART N^o XIX

SUBJECT N^o 5



DAILY RECORD FOR 90 DAYS

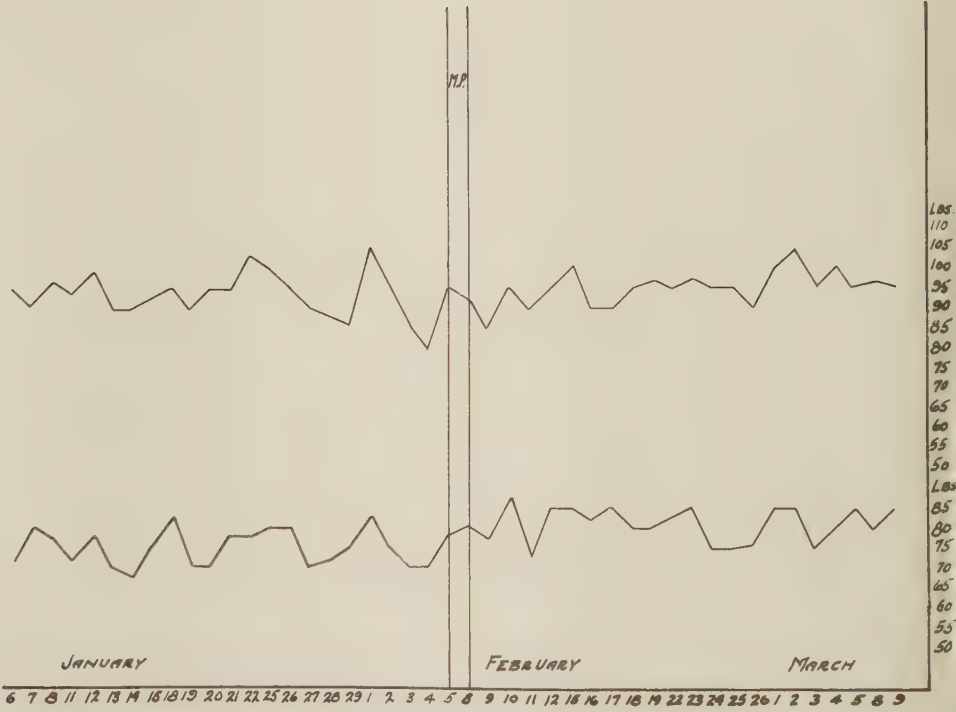
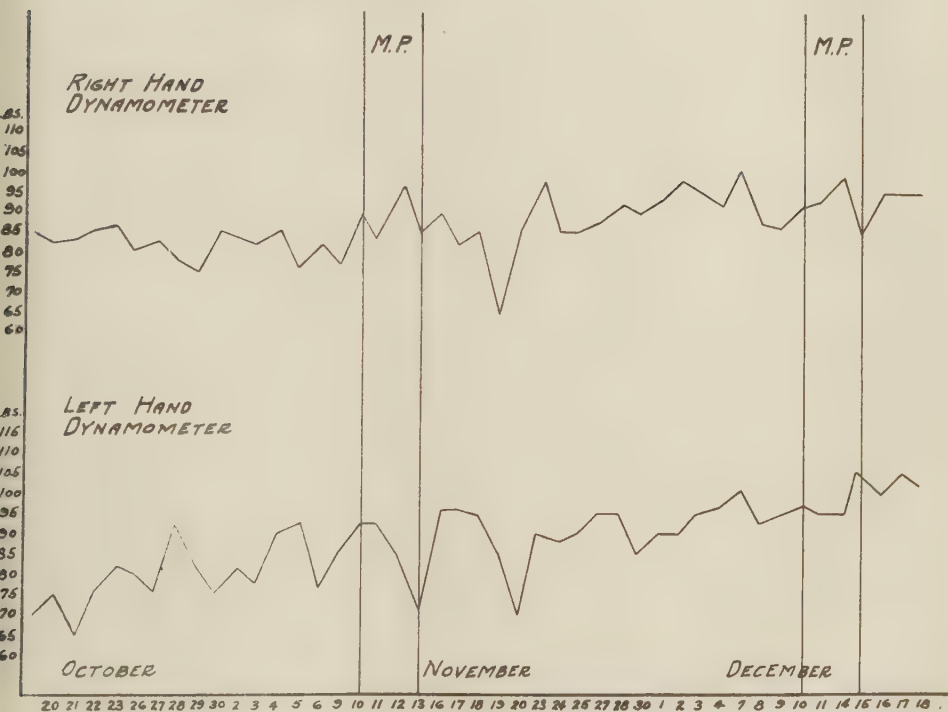


CHART N° XV

SUBJECT N° 6



DAILY RECORD FOR 30 Days

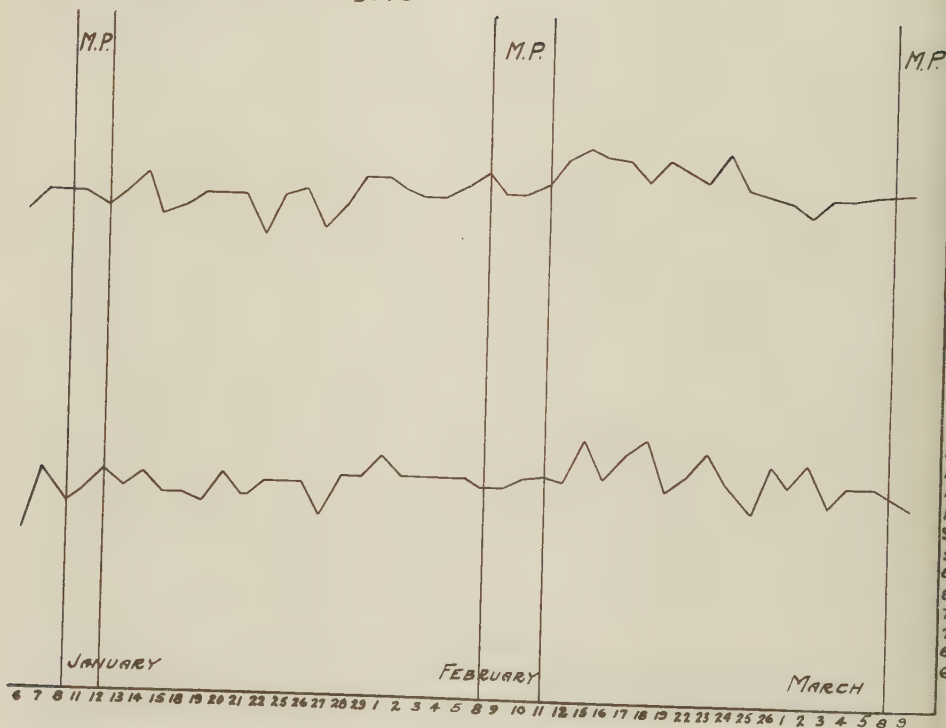


CHART XXI RIGHT HAND DYNAMOMETER AB GROUP

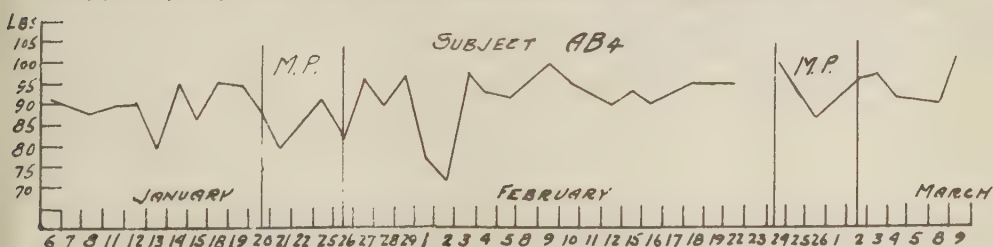
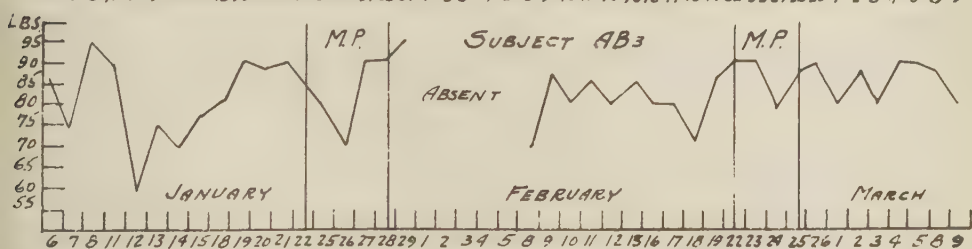
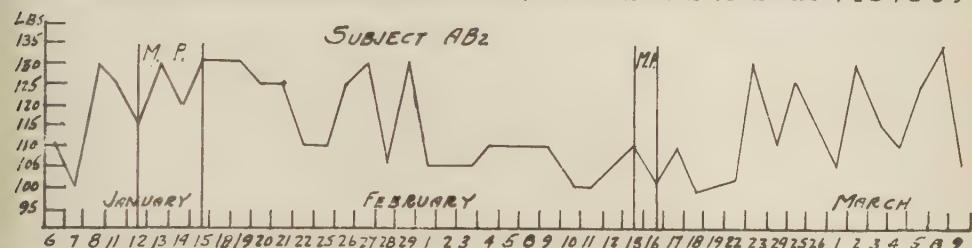
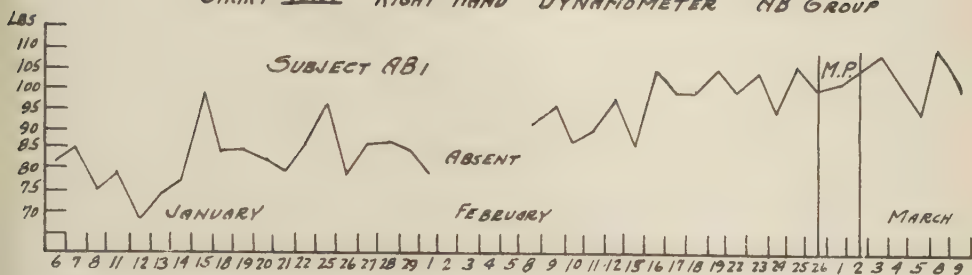
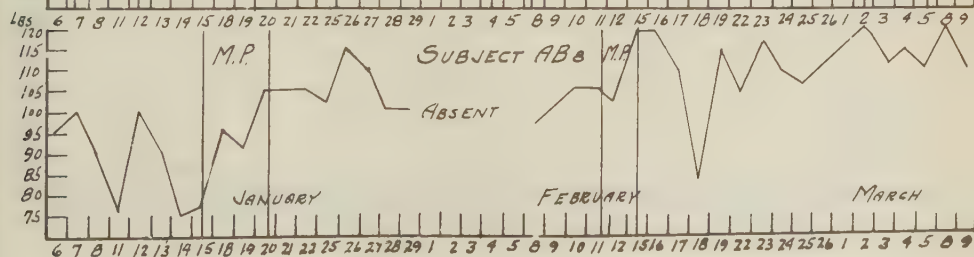
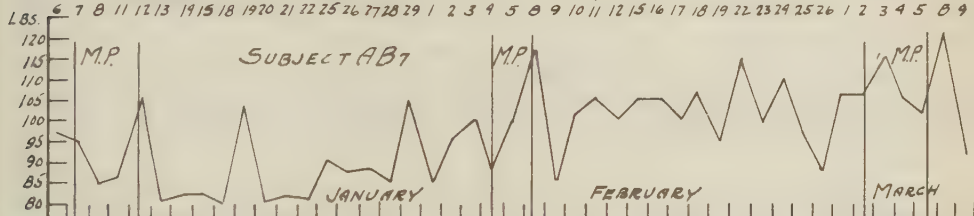
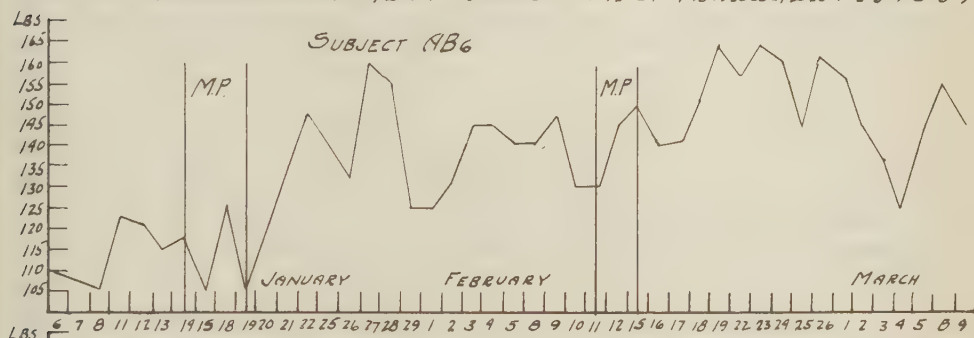
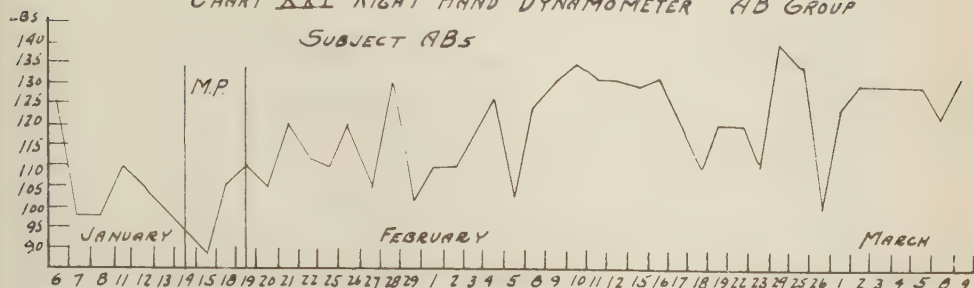
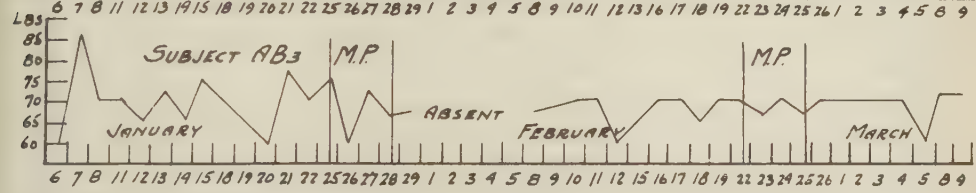
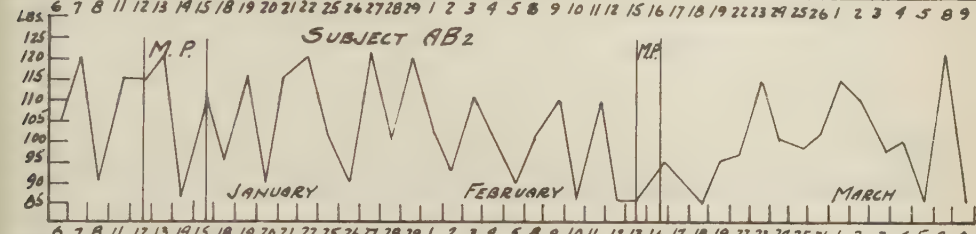
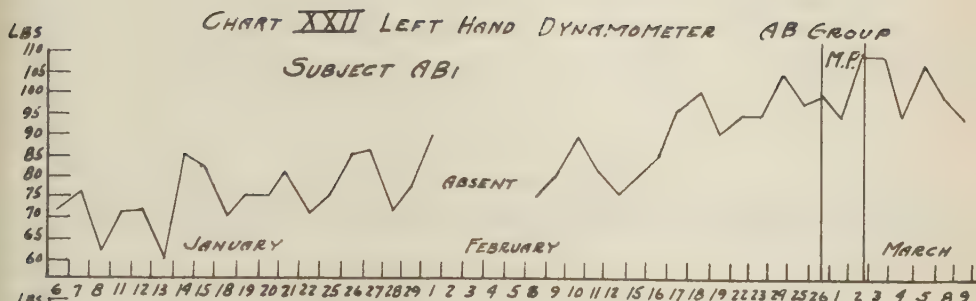


CHART XXI RIGHT HAND DYNAMOMETER AB GROUP
SUBJECT AB5





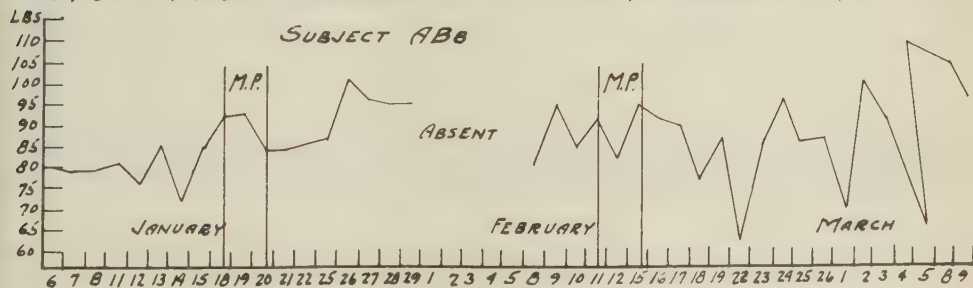
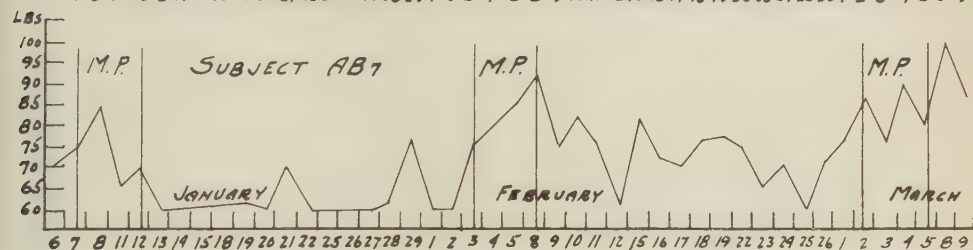
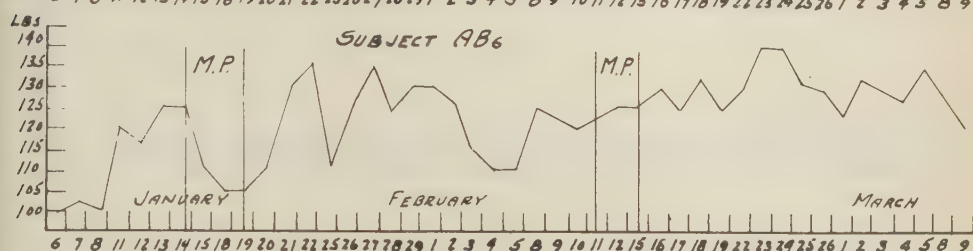
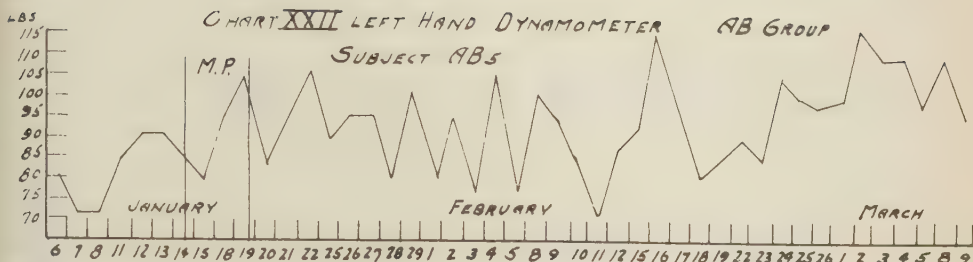


CHART XXIII COMPOSITE CURVE RIGHT HAND DYNAMOMETER - MEN

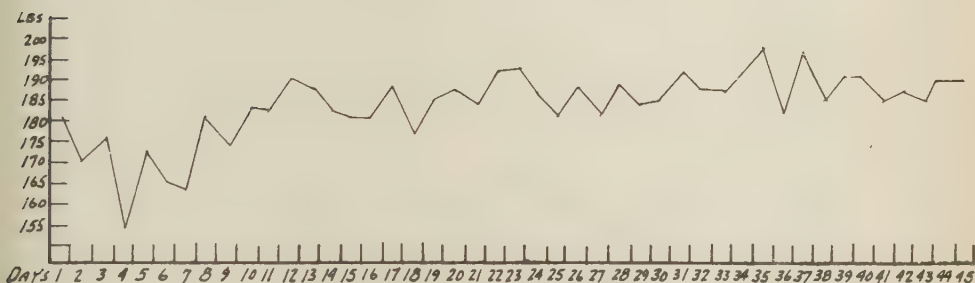
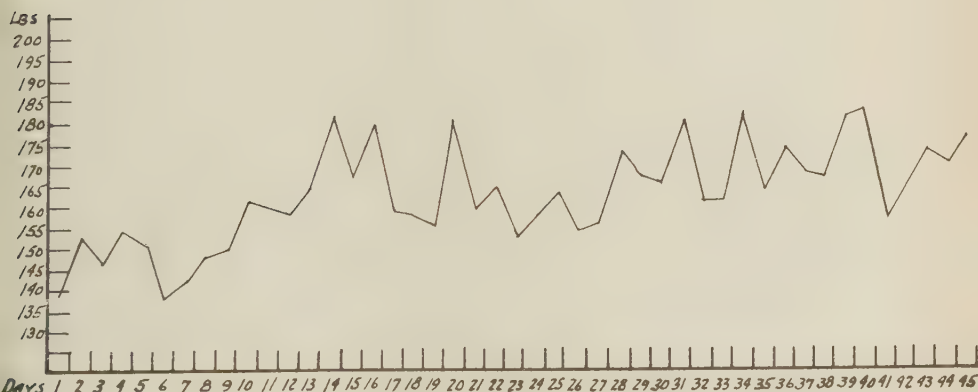


CHART COMPOSITE CURVE LEFT HAND DYNAMOMETER - MEN



CHAPTER VI

TESTS OF FOREARM STRENGTH

The hand dynamometer was used to test forearm strength, not because, as mentioned previously, it is a reliable index to the efficiency of the body as a whole, but because it gave additional interesting data which could be correlated with the other tests used in this experimental study. Right and left hands' records were kept separately on all tables and charts. It appears that temporarily increased strength in the right hand does not necessarily mean increased efficiency in left arm muscles on the same day. However, it seems that the practice curve moves at approximately the same general rate for both hands (especially noticeable in Charts 18 and 19), and that the two curves follow approximately the same path.

Tables 11 and 13 give the daily records for the right and left hand dynamometer tests, respectively. In the N group 10 critical first days were better than preceding normal days, five were worse. In the AB group 9 critical first days were worse than preceding normal days, while only six were better.

Charts 18, 19 and 20 give the curves, right and left hand, of the N group for 90 days. Charts 21 and 22 give the AB curves for the dynamometer, taken over 45 days.

Tables 12 and 14 give the individual variations from the group average figures in multiples of the mean variation. In the N group, right hand, 12 out of 24 were quite as poor as the average of the critical days. In the AB group, right hand, 10 out of 24 normal days were as inefficient as critical days. The left hand grip recorded in the N group 16 out of 24 days as inefficient as critical days, and in the AB group 10 out of 24 showed records just the same as or poorer than records made on menstrual days. Menstrual days, therefore, are no worse than many normal days.

The last chart, 23, shows the composite curve of the men's records, right and left hands. Except for the fact that men's grips are higher than women's, their curves could not be distinguished from those made by women, the same practice curve being evident from day to day, and the same variations.

TABLE 11

Daily Record of the Right Hand Dynamometer Test

The number of pounds strength as indicated by the hand dynamometer.
Menstrual periods indicated by a star (*).

Date Day	October 19, 1925, to December 18, 1925		
	N1	N2	N4
1	118	58	87
2	118	68	85
3	110	123	95
4	96	85	87
5	130	93	90
6	128	68	83
7	126	90	85
8	105	108	74
9	122	97	85
10	120	100	84
11	110	98	82
12	114	96	82
13	132	105	72
14	115	108	78
15	112	109	80
16	*125	*103	*75
17	*125	*105	*85
18	*108	*122	87
19	*138	*105	*85
20	125	105	90
21	125	100	83
22	115	86	72
23	108	93	82
24	108	103	82
25	105	85	88
26	105	93	78
27	105	98	82
28	105	105	83
29	100	95	85
30	100	103	82
31	93	105	70
32	115	100	73
33	108	105	82
34	105	105	85
35	95	105	76
36	92	*100	*75
37	100	*105	*87
38	100	*100	*62
39	90	105	*78
40	105	105	*65
41	95	90	78
42	105	85	93
43	97	104	82
44	110	108	95
45	130	96	68

TABLE 11

Daily Record of the Right Hand Dynamometer Test

Date Day	October 19, 1925, to December 18, 1925			January 6, 1926, to March 9, 1926		
	N3	N5	N6	N3	N5	N6
1	75	*60	85	105	95	90
2	*72	*55	82	108	90	95
3	*90	*76	83	110	96	*95
4	*85	*65	85	112	94	*95
5	85	58	86	110	90	*92
6	95	65	80	115	90	95
7	76	62	82	102	90	100
8	85	66	78	105	93	90
9	85	65	75	130	95	92
10	90	72	85	110	90	95
11	84	82	83	115	95	95
12	80	75	82	105	95	95
13	80	80	85	115	103	85
14	73	72	76	*115	100	95
15	72	68	72	*118	95	97
16	82	65	78	115	90	87
17	85	78	*90	110	88	93
18	76	85	*84	110	86	100
19	100	86	*96	108	105	100
20	*88	85	*85	107	95	97
21	*105	85	90	120	85	95
22	117	78	82	103	80	95
23	116	78	85	114	*95	98
24	105	80	65	120	*93	*100
25	105	82	86	126	85	*96
26	82	80	98	106	95	*96
27	93	75	85	110	90	*98
28	103	70	85	123	95	105
29	111	87	88	*118	100	108
30	98	92	92	*108	90	106
31	105	100	90	*102	90	105
32	112	100	93	*105	95	100
33	112	95	98	*110	97	105
34	115	95	95	100	95	103
35	111	100	92	120	97	100
36	*105	*95	100	100	95	107
37	*110	*95	87	102	95	98
38	*114	100	86	110	90	96
39	*100	92	*90	101	100	95
40	*120	90	*92	105	105	92
41	100	87	*98	100	95	96
42	110	95	*80	95	100	96
43	98	95	95	110	95	97
44	114	95	95	115	96	*abs.
45	105	95	95	100	95	*98

TABLE 11

Daily Record of the Right Hand Dynamometer Test

Date	January 6, 1926, to March 9, 1926							
Day	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8
1	82	111	88	92	125	110	98	95
2	85	100	76	90	98	108	*95	100
3	76	130	95	88	98	105	*85	90
4	80	125	90	90	110	123	*86	75
5	68	*115	60	90	105	122	*105	100
6	75	*130	75	80	100	115	80	90
7	78	*120	70	95	*92	*118	82	75
8	100	*130	78	87	*85	*105	82	78
9	85	130	80	95	*105	*125	80	*95
10	85	130	90	95	*110	*105	105	*93
11	83	125	89	*90	105	120	80	*105
12	80	125	90	*80	120	135	82	105
13	88	110	85	*87	113	148	80	105
14	96	110	*80	*92	110	140	90	102
15	80	125	*70	*82	120	133	88	115
16	87	130	*90	96	105	160	88	110
17	88	105	*90	90	130	155	85	100
18	85	130	95	97	102	125	105	100
19	80	105	abs.	77	110	125	85	abs.
20	abs.	105	abs.	73	110	130	95	abs.
21	abs.	105	abs.	98	118	145	100	abs.
22	abs.	110	abs.	93	127	145	*88	abs.
23	abs.	110	abs.	92	103	140	*100	abs.
24	92	110	70	95	125	140	*118	97
25	96	110	87	100	132	148	85	102
26	88	100	80	95	135	130	102	105
27	90	100	85	93	132	*130	105	*102
28	98	105	80	90	132	*145	100	*105
29	86	*110	85	93	130	*150	105	*120
30	105	*100	80	90	133	140	105	120
31	100	110	72	93	123	142	100	110
32	100	98	80	95	110	152	107	82
33	105	100	87	95	120	165	95	115
34	100	102	*90	95	120	158	115	105
35	105	130	*90	abs.	110	165	100	117
36	95	110	*79	*100	140	160	110	110
37	105	125	*87	*93	135	145	96	107
38	*100	111	90	87	100	162	87	111
39	*102	105	80	90	125	158	106	116
40	*105	130	87	96	130	145	*107	122
41	109	115	80	97	130	137	*115	112
42	103	110	90	92	130	125	*105	115
43	95	125	90	92	130	145	*102	110
44	110	135	88	90	122	155	122	122
45	100	105	80	102	132	145	92	110

TABLE 11

Daily Record of the Right Hand Dynamometer Test

Date	October 19, 1925, to December 18, 1925		January 6, 1926, to March 9, 1926	
Day	M5	M1	M2	M4
1	185	172	190	178
2	180	145	185	172
3	190	158	182	175
4	153	130	165	168
5	172	135	195	193
6	180	150	160	172
7	145	163	170	178
8	190	170	185	180
9	185	175	145	193
10	175	175	190	195
11	180	160	200	195
12	176	185	200	200
13	185	165	195	210
14	168	160	210	195
15	180	170	195	200
16	170	160	195	200
17	185	160	200	210
18	146	180	200	185
19	175	165	200	200
20	195	170	200	185
21	183	165	200	190
22	195	175	200	200
23	185	185	200	202
24	165	185	210	195
25	160	185	200	200
26	170	175	200	200
27	172	185	185	200
28	182	175	202	200
29	180	168	190	200
30	165	172	203	200
31	198	175	195	200
32	180	180	210	185
33	190	175	195	190
34	195	165	210	200
35	200	188	200	210
36	165	171	185	210
37	185	185	200	215
38	150	185	195	210
39	176	180	200	210
40	177	185	195	210
41	160	177	195	210
42	170	180	192	210
43	180	180	195	210
44	160	182	210	210
45	175	178	200	210

TABLE 12
Right Hand Dynamometer Test
First Period

— = worse than the average
+ = better than the average

A record of each individual variation from the average, reduced to a multiple of the mean variation of the group, figured in six day periods before and after, and four day periods during menstruation.

N1	N2	N3	N4	N5	N6	Algebraic sum	Average
+1.86	+0.53	-0.87	-0.53	.....	-0.66	+0.33	+0.06
+2.33	+1.00	-1.00	-0.77	.....	-0.42	+0.14	+0.02
+2.00	+0.61	-0.35	-0.43	.....	-0.41	+1.42	+0.28
+2.35	+0.76	-0.69	-1.17	.....	-0.68	+1.58	+0.31
+1.12	+1.31	-1.05	-0.93	.....	-0.33	+0.12	+0.02
+1.66	+1.46	+0.41	-0.46	.....	-0.58	+2.19	+0.43
*+2.17	*+0.88	*-0.65	*-0.76	*-1.04	*-0.30	*+0.35	*+0.05
*+2.37	*+0.4	*	*-0.69	*-1.34	*-0.58	*+0.60	*+0.12
*+0.82	*+1.65	*	-0.41	*-0.20	*-0.55	*+1.31	*+0.25
*+4.11	*+0.44	*+0.58	*-0.66	*-3.16	*-0.91	*+0.40	*+0.06
+2.41	+0.16	+1.85	-0.50	-2.28	-0.65	+1.02	+0.17
+2.25	-0.35	+2.33	-1.25	-1.31	-0.66	+0.91	+0.15
+1.00	+0.41	+1.00	-1.35	-1.78	-0.25	-0.97	-0.16
+1.66	+0.85	+1.75	-0.50	-1.42	-1.80	+0.49	+0.08
+1.21	-0.76	-0.77	-0.64	-1.63	-0.62	-3.21	-0.54
+1.75	-0.44	+0.37	-0.57	-1.33	+1.00	+1.86	+0.31

TABLE 12
Right Hand Dynamometer Test
Second Period

- = worse than the average
+ = better than the average

N1	N2	N3	N4	N5	N6	Algebraic sum	Average
.....	+1.16	-2.33	+0.33	-0.66	-0.25	-1.75	-0.35
.....	+1.90	-2.09	+1.90	+0.63	-0.71	+1.64	+0.32
.....	+0.22	-2.77	+1.55	+0.22	+0.50	+4.38	+0.87
.....	+0.62	-2.25	+1.42	-0.63	+0.85	+0.20	+0.04
.....	+0.71	-2.14	+1.87	-0.71	-1.25	-1.97	-0.39
.....	-1.12	-2.50	+1.87	+0.50	-0.58	-1.83	-0.36
*	+0.85	*-2.71	*+1.57	*+1.42	*-0.28	*+0.85	*+0.17
*	+1.00	*-1.25	*+2.25	*-0.25	*-0.30	*+1.45	*+0.29
*	+0.58	*-2.58	*+1.41	*	*+0.43	*+0.14	*+0.03
*	.....	*-2.00	*+1.14	*	*-1.75	*-2.61	*-0.87
.....	+1.85	-2.27	+2.45	+0.58	-2.27	+0.45	+0.09
.....	+0.69	-0.12	+2.00	0.00	-0.12	+2.35	+0.47
.....	-0.27	-1.85	+0.42	-0.46	-1.85	-4.01	-0.80
.....	-1.12	-0.87	+1.50	-0.54	-0.87	-1.60	-0.32
.....	+1.28	-2.30	+0.53	-0.12	-2.30	-2.89	-0.57
.....	+0.75	.....	.....	0.00	.....	+0.75	+0.37

* * * *

TABLE 12
Right Hand Dynamometer Test
First Period

— = worse than the average
+ = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
.....	.....	AB3	AB4	AB5	AB6	AB7	AB8		
.....	.....	—1.00	—0.29	+2.19	+0.88	—1.80	—0.53	—0.55	—0.09
.....	.....	—1.00	—0.61	+0.32	+1.80	+0.99	—1.58	—1.86	—0.31
.....	+0.96	—1.00	+0.43	+0.17	+0.88	+0.10	+0.29	+2.83	+0.40
.....	+0.78	—0.43	—0.25	+0.77	+1.53	—0.75	—0.05	+1.78	+0.25
.....	+3.00	—0.47	—0.11	+0.59	+1.58	—0.16	—1.20	+2.93	+0.41
.....	+1.65	—1.00	—0.54	+0.50	+1.33	—0.92	—0.81	+0.21	+0.03
*	*+1.17	*—1.47	*—0.43	*+0.25	*+1.25	*—1.14	*—0.11	*+0.62	*+0.06
*	*+2.16	*+1.08	*—0.95	*—0.37	*+0.87	*—0.69	*—0.72	*+1.38	*+0.19
*	*+2.00	*+0.80	*—0.82	*+0.47	*+1.64	*+0.72	*+0.43	*+5.24	*+0.74
*	*+2.43	*—0.75	*—0.62	*+0.81	*+0.36	*	*	*+2.23	*+0.44
.....	+1.93	—0.90	—0.50	+0.50	+1.43	—1.37	+0.19	+1.28	+0.18
.....	+2.63	.....	—0.75	+0.95	+1.66	—0.14	+0.18	+4.53	+0.74
.....	+1.75	.....	—0.70	+0.64	+2.70	+0.07	+0.06	+4.52	+0.75
.....	+1.19	.....	—1.25	+0.50	+2.47	—0.37	+0.66	+3.20	+0.53
.....	+0.47	.....	—1.93	—0.87	+1.40	—0.27	—0.20	—1.40	—0.25
.....	+1.12	.....	+1.07	—0.05	+2.70	—0.26	—0.23	+4.35	+0.72

TABLE 12
Right Hand Dynamometer Test
Second Period

— = worse than the average
+ = better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
-0.12	+0.07	-1.62	-1.26	.....	+2.27	+0.33	.....	-0.33	-0.05
-0.31	+0.27	-1.38	-1.00	.....	+1.57	-0.87	.....	-1.72	-0.28
-0.66	+0.18	-1.93	-0.43	.....	+2.38	-0.16	.....	-0.62	-0.10
-0.61	-0.28	-1.62	-0.88	.....	+1.94	-0.88	.....	-2.33	-0.38
-1.00	-0.21	-1.87	-1.00	.....	+2.50	-1.11	-0.44	-3.13	-0.44
-0.35	-0.06	-1.43	.....	.....	+1.85	-0.23	-0.31	-0.53	-0.08
*-0.35	.....	*-1.33	*-0.72	*	*+1.85	*-0.50	*+0.07	*-0.98	*-0.16
*	*	*-1.44	*-1.05	*	*+2.43	*+1.27	*-0.13	*+0.88	*+0.17
*	* 0.00	*-1.88	*-1.11	*	*	*-0.27	*-0.31	*-0.04	*-0.67
*-0.47	*	*-1.41	*-1.17	*	*+2.22	*-0.60	*+0.54	*-1.64	*-0.23
*-0.62	*-0.60	.....	.....	.....	.....	.....	.....	.....	.....
-1.07	+0.21	-0.93	-0.53	.....	+2.06	+0.25	+0.73	+0.72	+0.10
-0.45	-0.75	-1.77	-1.45	.....	+2.43	-1.06	+0.21	-2.84	-0.40
+1.06	-0.62	-0.18	-1.26	.....	+3.25	.....	-1.25	+1.00	+0.16
-0.50	-0.53	-1.14	-1.75	.....	+3.23	.....	+0.31	-0.38	-0.06
+0.53	+0.82	-1.63	-0.40	.....	+3.20	.....	-0.33	+1.19	+0.19
.....	-0.16	-0.74	.....	.....	+2.72	.....	+0.05	+1.87	+0.46

TABLE 13

Daily Record of the Left Hand Dynamometer Test

The number of pounds strength as indicated on the hand dynamometer.
Menstrual periods indicated by a star (*).

Date	October 19, 1925, to December 18, 1925		
Day	N1	N2	N4
1	125	60	88
2	128	65	75
3	123	68	78
4	105	74	87
5	128	58	76
6	130	85	85
7	120	70	72
8	105	73	73
9	118	78	78
10	96	79	73
11	112	80	72
12	125	78	78
13	110	75	78
14	100	78	62
15	122	75	65
16	*125	*80	*78
17	*115	*78	*70
18	*128	*82	*91
19	*134	*71	*75
20	130	73	96
21	128	98	70
22	135	85	74
23	120	77	90
24	111	75	68
25	115	81	80
26	107	60	80
27	93	73	82
28	100	70	71
29	98	70	80
30	94	73	78
31	98	80	70
32	122	70	75
33	85	80	72
34	115	80	80
35	105	75	80
36	107	*75	*75
37	115	*95	*70
38	105	*65	*70
39	97	98	*82
40	105	78	*65
41	96	75	85
42	111	75	83
43	105	75	84
44	117	73	90
45	120	70	70

TABLE 13

Daily Record of the Left Hand Dynamometer Test

Date Day	October 19, 1925, to December 18, 1925			January 6, 1926, to March 9, 1926		
	N3	N5	N6	N3	N5	N6
1	63	*62	70	85	72	90
2	*68	*54	75	85	80	105
3	*50	*68	65	90	78	*98
4	*62	*54	76	95	72	*100
5	58	52	82	107	78	*105
6	60	58	80	80	70	102
7	65	54	76	80	68	105
8	70	58	92	80	75	100
9	65	65	82	78	82	100
10	65	73	75	70	70	98
11	66	62	81	77	70	105
12	72	55	78	76	78	100
13	74	70	90	73	78	103
14	58	62	93	*68	80	103
15	62	72	76	*60	80	103
16	45	60	85	80	70	95
17	52	60	*90	80	72	105
18	58	73	*92	70	75	105
19	70	63	*85	75	83	110
20	*68	75	*71	75	75	105
21	*80	75	95	90	70	105
22	96	72	96	85	70	105
23	85	72	95	85	*78	105
24	80	72	85	90	*80	*103
25	85	75	70	95	77	*103
26	76	70	90	75	87	*105
27	78	70	88	78	73	*106
28	91	80	90	85	85	105
29	98	78	95	*78	85	115
30	95	80	95	*89	82	106
31	80	75	85	*80	85	112
32	96	75	90	*70	80	115
33	82	72	90	75	80	103
34	96	75	95	76	83	107
35	93	70	96	86	85	113
36	*87	*75	100	62	75	105
37	*82	*60	93	76	75	98
38	*86	75	95	67	76	110
39	*87	70	*96	65	85	105
40	*85	70	*95	85	85	111
41	100	75	*95	64	75	100
42	78	60	*105	87	80	105
43	72	65	100	70	85	105
44	80	60	105	85	80	*abs.
45	86	78	102	68	85	*100

TABLE 13
Daily Record of the Left Hand Dynamometer Test

Date	January 6, 1926, to March 9, 1926							
Day	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8
1	72	105	60	78	80	100	70	80
2	76	120	65	80	72	103	*75	79
3	62	91	87	85	72	100	*85	79
4	72	115	70	80	85	120	*65	80
5	72	*115	70	60	90	116	*70	76
6	60	*120	65	55	90	125	60	85
7	85	*87	67	77	*85	*125	60	72
8	83	*110	75	60	*80	*110	60	85
9	70	95	70	80	*95	*105	62	*92
10	75	117	63	80	*105	*105	62	*93
11	75	90	60	*75	85	110	60	*87
12	80	115	77	*70	95	130	70	87
13	72	120	70	*80	108	136	60	90
14	75	102	*75	*72	90	110	60	92
15	85	90	*60	*62	95	125	60	102
16	87	122	*73	85	95	135	60	97
17	72	100	*66	77	80	125	63	95
18	77	120	67	90	102	130	77	95
19	90	103	abs.	65	80	130	60	abs.
20	abs.	93	abs.	83	95	127	60	abs.
21	abs.	110	abs.	78	77	115	75	abs.
22	abs.	98	abs.	83	105	110	*80	abs.
23	abs.	90	abs.	80	77	110	*85	abs.
24	75	100	67	85	100	125	*93	80
25	80	110	68	96	95	123	75	95
26	95	85	70	85	85	120	82	85
27	82	110	70	80	72	*123	76	*83
28	76	85	60	85	88	*125	60	*92
29	80	*85	65	85	93	*125	83	*95
30	85	*95	70	70	116	130	73	92
31	98	90	70	76	98	125	70	90
32	103	85	65	83	83	133	76	77
33	91	95	70	83	85	125	77	87
34	95	97	*70	80	90	130	75	63
35	95	115	*67	abs.	86	140	65	87
36	105	100	*70	*85	105	140	70	96
37	98	98	*67	*90	100	132	60	85
38	*100	102	70	*76	98	130	72	87
39	*95	115	70	*85	100	123	78	70
40	*110	110	69	*96	120	133	*87	100
41	110	97	70	87	110	129	*75	92
42	95	100	70	87	110	128	*90	110
43	108	85	70	85	98	135	*80	65
44	100	122	60	85	110	128	100	105
45	95	85	72	98	95	120	87	97

TABLE 13

Daily Record of the Left Hand Dynamometer Test

Date Day	October 19, 1926, to December 18, 1925		January 6, 1926, to March 9, 1926	
	M5	M1	M2	M4
1	160	125	152	122
2	175	128	160	146
3	150	140	175	120
4	163	130	185	138
5	150	125	175	155
6	148	130	140	130
7	143	143	145	140
8	164	145	145	140
9	178	150	128	145
10	165	167	170	145
11	148	137	160	120
12	145	143	175	170
13	180	150	195	135
14	160	130	178	180
15	175	150	175	170
16	165	130	165	165
17	176	125	172	165
18	185	135	180	135
19	148	127	185	162
20	172	135	175	160
21	178	120	180	160
22	165	120	190	182
23	145	145	155	170
24	163	130	172	163
25	187	140	145	168
26	155	138	158	180
27	165	140	152	168
28	170	150	175	176
29	175	135	185	200
30	165	128	190	175
31	198	120	190	178
32	180	126	188	180
33	180	142	158	152
34	200	158	177	168
35	175	165	142	195
36	190	161	178	175
37	185	165	177	170
38	170	156	170	150
39	165	150	175	172
40	170	167	185	155
41	160	130	175	210
42	175	155	163	160
43	170	159	190	abs.
44	170	145	193	175
45	180	168	180	178

TABLE 14
Left Hand Dynamometer Test
First Period

A record of each individual variation from the average, reduced to a multiple of the mean variation of the group, figured in six day periods before and after, and four day periods during menstruation.

— = worse than the average
+ = better than the average

N1	N2	N3	N4	N5	N6	Algebraic sum	Average
+2.71	+0.28	-1.14	-0.71	.....	+0.25	+1.39	+0.27
+2.83	+0.16	-1.14	-0.50	.....	-0.20	+0.99	+0.33
+2.93	-0.20	-1.43	-0.20	.....	+1.20	+1.82	+0.36
+2.54	-0.63	-1.52	-0.36	.....	-0.20	+1.23	+0.24
+1.60	-0.20	-1.81	-0.86	.....	+0.30	-1.47	-0.29
+2.86	-0.26	-0.68	-0.93	.....		+1.29	+0.25
*+2.04	*+0.08	*+0.84	*	*-0.84	*+0.82	*+2.94	*+0.49
*+2.21	*+0.05	*	*-0.41	*-1.91	*+0.31	*+0.25	*+0.05
*+2.56	*-0.31	*	*+0.25	*-0.41	*+0.15	*+2.24	*+0.44
*+2.68	*-1.10	*-0.78	*-0.42	*-1.15	*-0.77	*-1.54	*-0.25
+2.50	+0.50	+0.18	+0.61	-1.15	+0.28	+2.92	+0.48
+2.64	-0.50	-0.46	-1.43	-1.47	+0.18	-1.04	-0.17
+2.06	-1.08	-0.10	-1.18	-1.15	+0.41	-1.04	-0.17
+2.50	-0.60	+0.10	0.00	-1.54	-0.40	+0.06	+0.01
+3.00	-0.30	-0.94	-1.30	-1.13	-1.40	-2.07	-0.39
+3.10	-1.17	-0.28	-0.40	-0.76	+0.58	+1.07	+0.17

TABLE 14
Left Hand Dynamometer Test
Second Period

- = worse than the average
+ = better than the average

N1	N2	N3	N4	N5	N6	Algebraic sum	Aver- age
.....	-1.33	-0.54	+1.14	-1.09	+1.00	-0.85	-0.17
.....	-0.20	-0.20	-0.20	-1.20	+0.45	-1.35	-0.27
.....	-1.20	-0.76	+0.53	-0.76	+0.90	-1.29	-0.25
.....	0.00	-1.60	+0.40	-1.60	+1.27	+2.53	+0.50
.....	-0.90	-0.90	+0.54	-1.36	+0.53	-2.09	-0.41
.....	-1.00	-0.54	+0.63	-1.45	+1.08	-1.28	-0.27
*	.....	*-1.00	*+0.98	*-1.00	*+1.22	*+0.20	*+0.03
*	*-1.00	*-1.00	*-0.20	*-1.60	*+1.00	*-2.80	*-0.56
*	*+0.66	*-1.00	*+2.85	*	*+0.88	*-3.39	*+0.84
*	*-1.41	*-0.33	*+0.22	*	*+1.33	*-0.19	*-0.004
.....	+1.44	-0.11	+1.44	-0.58	+1.37	+3.57	+0.71
.....	-0.45	-0.13	-0.46	-1.66	+1.12	-1.58	-0.31
.....	-1.33	+0.76	-0.84	-0.63	+1.00	-1.04	-0.20
.....	-0.66	+0.18	-0.43	-1.33	.....	-2.24	-0.56
.....	-0.61	-1.13	-0.06	-1.66	.....	-3.46	-0.84
.....	-0.87	.....	.....	-1.38	.....	-2.25	-1.12

TABLE 14
Left Hand Dynamometer Test

First Period

-- worse than the average
+ == better than the average

AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
.....	.....	-0.78	-1.53	0.00	+1.81	-1.95	-0.25	-2.70	-0.45
.....	.....	-0.83	-1.17	-0.80	+1.35	-1.43	-0.37	-2.25	-0.37
.....	+2.77	-1.05	-0.28	-1.12	+1.50	-1.00	-0.46	+0.36	+0.05
.....	+2.57	-1.14	-1.05	-0.06	+2.12	-1.61	+0.13	+0.96	+0.13
.....	+1.25	-1.16	-0.41	+0.46	+1.53	-1.93	-0.64	-0.90	-0.12
.....	+1.81	-0.67	-0.47	+0.34	+1.86	-0.94	+0.26	+2.19	+0.31
*	*+1.46	*-1.00	*-0.28	*+0.28	*+3.15	*-1.36	*+0.58	*+2.83	*+0.40
*	*+1.65	*-0.64	*-1.00	* 0.00	*+1.57	*-0.33	*+0.27	*+1.52	*+0.21
*	*+0.42	*-1.55	*-0.54	*+0.83	*+1.66	*+0.21	*+0.57	*+1.60	*+0.22
*	*+1.57	*-0.81	*-0.86	*+1.00	*+1.06	.....	*	*+1.96	*+0.39
.....	+0.83	-1.55	-0.30	+0.42	+2.33	-1.21	-0.05	+0.47	+0.06
.....	+1.70	.....	-0.56	+0.38	+2.00	-0.66	-0.09	+2.77	+0.46
.....	+0.78	.....	-0.28	+0.73	+1.66	-0.80	+0.46	+2.55	+0.42
.....	+1.50	.....	-1.00	+0.37	+2.27	-1.73	+0.93	+2.34	+0.39
.....	+1.27	.....	-0.50	+0.52	+2.20	-0.33	+0.30	+3.46	+0.57
.....	+1.13	.....	-0.76	+0.20	+2.43	-0.94	+0.56	+2.62	+0.43

TABLE 14
Left Hand Dynamometer Test

Second Period

— = worse than the average
+ = better than the average

	AB1	AB2	AB3	AB4	AB5	AB6	AB7	AB8	Algebraic sum	Average
*	+0.61	*	*-1.06	*-0.61	*	*+2.33	*-1.06	*-0.33	*-0.12	*-0.02
*	.....	*	*-1.36	*-0.06	*	*+2.60	*-1.40	*+0.26	*+0.04	*+0.006
*	+0.18	*	*-1.44	*-1.23	*	*	*-0.64	*-0.20	*-4.33	*-0.72
*	+0.46	*	*-1.50	*-0.43	*	*+2.70	*-0.47	*+0.60	*+1.09	*+1.15
	+0.93	+1.21	-0.92	-0.60		+2.22	-0.15	+0.11	+2.80	+0.40
	-0.28	+0.06	-1.37	-0.85		+1.92	-0.60	+0.85	-0.27	-0.03
	+1.17	-0.44	-2.26	-0.17		+2.93		-0.80	+0.43	+0.07
	-0.15	+0.62	-1.73	-0.95		+4.22		0.00	+2.01	+0.35
	+0.20	+1.15	-2.07	-0.50		+2.68		-1.80	-0.34	-0.05
	.....	+0.22	-1.64	.....		+2.47		+0.31	+1.36	+0.34

CHAPTER VII

CONCLUSIONS

In submitting the conclusions drawn from this experimental study, several factors which detract from the value of these conclusions may come to mind. It will be remembered that the entire subject of menstruation has long been, and still is, a subject of controversy and differences of opinion. Certain phases of the physiological function are still an unsolved mystery, therefore the disparity between accepted ideas and results of scientific study is not surprising.

It might be objected that the number of subjects under observation was far too small to allow any conclusive evidence. This is admissible, but the reader is reminded that the six normal girls and the eight abnormal, as well as the five controls, were tested every day except Saturdays and Sundays, in contrast to other experiments in this field in which the subjects were tested less frequently. Three of the normal girls were tested for a period of 90 days. It was obviously a difficult task to secure any great number of students who had the interest and time necessary for the successful completion of this study. The students all undertook the task without compensation and without a knowledge of the meaning of the experiment. As far as could be determined, each of the three groups represented a fair, though small, sample of the average college girls and boys. Moreover, it will be noted that all conclusions support the negative side of the question, namely, that menstruation does not affect motor ability of women.

It might be objected also that the tests measured only a momentary ability, i. e., a variable quantity, and did not take into account the large and important element of fatigue. Such a study would be highly profitable, but could be carried on only in an experimental laboratory under the strictest test conditions over a long period of time. A study of the effect of menstruation on bodily fatigue might, it is true, yield different results from those herein stated. However, this is doubtful, since the critical periods of three subjects, N3, AB3, and AB4, occurred simultaneously with the period of semester examinations, when fatigability and nervous strain were naturally greatest and still their test results were no worse than the results obtained during other critical periods. It may be presumed, since none of the subjects understood the true meaning of the experiment, that they had no ulterior motive for diminishing their speed, skill, interest or effort during test periods.

Again, there is the question of interest and co-operation, since it is true that the success of motor ability tests depends partly on these two factors. These tests were correlated directly

with their physical education class work and athletic sports and hence the element of practicability and real interest entered into them. Several of the subjects took their tests at practically the same hour of the day and were present together in the testing gymnasium. This encouraged competition and rivalry and keener interest in the project. The result was constant striving to better scores.

The question of the personal index, the psychic influence or the influence of age-old habits of thinking handed down through generations of well-meaning though unscientific mothers enters in. Undoubtedly, this is a tremendous factor in menstruation, since so much of the so-called dysmenorrhea and discomfort at these times is largely psychic. It has been stated by many that the *sense* of well-being is diminished at menstrual times. We tend to be always what we are expected to be. Tradition that women are incapacitated increases the idea of impaired efficiency. The AB group, in this study, was made up of girls who were not pathological cases, but who deviated slightly from the N group in that they frequently suffered pain or discomfort, mental or physical, and varying in degree. Yet the records of this group, taken all in all, were as good as or even slightly better than those of the N group. Examination of the various mean variation tables shows that out of 336 normal days, 64 normal days of the AB group and 65 normal days of the N group (a total of 129 days), were the same as or poorer than the averages of critical days. Slightly more than one-third of the normal days recorded scores as low as those found on menstrual days. Menstruation, therefore, is obviously not a period of impaired skill, speed, and accuracy of movement, even in the group which would be most expected to show this periodic invalidism.

Although it is conceded that in any given group certain pathological cases will be found, this study did not attempt to cover that data and the results would not, therefore, be applicable to that group. Such data concerning these cases form an interesting study by themselves and may be secured rather easily from hospitals and institutions.

The practice element is apparent in these tests as in other mental and motor tests. However, it will be noted that the curve continues its unbroken line, even during menstrual periods, and that the general slope of the curve is upward, showing increased efficiency as time goes on.

It is true, therefore, that this study is limited to a few subjects, a selected, though average, group of college women and that it does not cover the question of motor ability of women in *all* sports over long periods of time and under diverse conditions. It does, however, cover by means of concrete and easily measurable motor tests certain important traits, such as accuracy of

arm and leg motion, speed, agility, and forearm strength, all necessary elements in athletic games and fundamental bases thereof. The need for further study in this field is great and the opportunities for research are unlimited.

In summarizing the conclusions, it is well to keep in mind certain questions to be answered in part, or in whole, by this paper:

1. What is the actual effect of periodicity on the motor ability of women in certain sports?

2. If inefficiency is found, is it present during all or part of the period?

3. Is there a period of maximum efficiency, regularly recurring each month?

4. Is there a difference in variability during critical periods between speed events, accuracy and strength tests?

5. Does the menstrual period show a greater or less variability of performance than any period of normal days?

6. And, finally, what are the implications related to other professions?

These questions may be answered briefly in their order as follows:

1. The careful application of standardized motor ability tests does not reveal a periodic inefficiency or diminishing of skill, speed and accuracy of motion in normal women or in those deviating slightly from the normal psychically or physically. Increased or decreased efficiency during critical periods appears to be solely a matter of chance, not based on physiological reasons.

2. In cases where inefficiency is found, it is usually during only part of the period. It may be the first day, though not usually, or occur on any day. Improvement due to practice continues unabated from week to week.

3. There is no period of maximum efficiency, as such, each month. A tendency towards a rhythm of performance with a short period of inefficiency every few days is discernible. This has no relation to periodicity. First days of menstrual periods, thought to be particularly affected by the process, are very often more efficient than the days immediately preceding or following them, showing that energy and skill is not diminished at that time. There seems to be no agreement between these results and the various physiological changes such as blood pressure, respiration rate, etc., referred to in Chapter I.

4. There is no discernible difference in variability during critical periods in the different types of motor tests. On the whole, however, the basketball dribble, a speed event, shows the least number of daily variations, and hence maintains the most regular curve. This does not hold good for the other speed

events, the general test and the soccer dribble. High and low periods are present in all types of tests.

5. The menstrual periods show no greater or less degree of variability than periods of normal days. Fluctuations occur in men's records as well as women's, from day to day, occasioned by diverse conditions beyond control and accurate explanation.

6. The implications of these findings to other professions besides physical education are varied and far reaching. Since there are no periods of marked depression among normal women, this sex needs no longer to be regarded as periodic invalids whose efficiency and working capacity are diminished every month.

The interest of industrial professions, which employ large numbers of women, should be more keenly focused on menstruation. So far the studies have concentrated on absenteeism and the gynecological effects of certain professions and types of work. A study might well be undertaken to ascertain the effect of menstruation on the actual work output of women. Such a study would correlate closely with the present paper. If a high rate of piece work production is the aim, and if women are inefficient from one to five days each month, their output will be materially lessened during these critical days, and they are, in consequence, poor labor material. Whether this lessened output, if it be lessened, can be made up by increased efficiency on normal days is an interesting point worthy of scientific study.

Certain professions still grant "sick" leave each month, and this vacation, necessary or unnecessary, is naturally made use of by employees. Other professions have never recognized "sick" periods, and housekeepers, dancers, circus performers, etc., continue their duties and work from day to day throughout the year. The circus profession, which calls for the highest degree of efficiency, accuracy of motion, skill and agility, expects its employees to continue their dangerous and highly skilled work every day regardless of critical periods.

Such investigations as that recently undertaken by the National Amateur Athletic Federation, Women's Division, will be a valuable aid in solving this health problem and in dispelling, once and for all, the universal fallacy about women's periodic irresponsibility. Women are surviving the rigors of professional life; they are graduating in hordes each year from universities with apparently increased health; they are competing more and more successfully with men in all lines of work, thus demonstrating their ability and intelligence. It is now time that they maintain their new position in the world's work by a saner viewpoint on the subject of menstruation—a viewpoint which recognizes the so-called periodic inefficiency in normal women as a delusion to be discarded in the light of scientific health education.

In closing, we say with Clelia Mosher (57):

"Sex is not a disability and if some method is found of adjusting work to the individual's strength under hygienic conditions with reference to sex, there is no reason why the potential power of woman may not be used without danger of lessening her racial efficiency."

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